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## NATURAL PRODUCTS OF THE EMPIRE*

"THE natural products of the Empire and the chemical industries that are or might be based on them" was the subject of discussion at a meeting of the Empire Scientific Conference which was presided over by Dr. J. L. Simonsen, Senior Research Scientist in the Colonial Office. The Conference decided that research on the utilisation of raw materials should be regionalised as far as possible in view of the shortage of scientific man-power in the Empire and recommended the formation of a central board of representatives of the Dominions, India, the Colonies and the United Kingdom to co-ordinate and guide research on the utilisation of the natural products of the Empire.

Sir J. C. Ghosh and Dr. D. N. Wadia presented a paper on "A Survey of Indian Chemical Industry in relation to Raw Materials and other existing Industries of India". The raw materials available, the scope and extent of the existing industries and their war-time developments, were surveyed and suggestions made for expansion of the following industries:—manufacture of chemicals, textiles, soaps, leather, paper, sugar, glass and ceramics, paints and varnishes, drugs, rubber goods, hydrogenated oils, synthetic fertilisers and insecticides. Most of the raw materials for the chemical industry are available in India. In the production of ilmenite, monazite and beryl, India holds a strategic position. In view of the large imports of petrol the fullest use must be made of benzol, now being produced from the high temperature coke ovens which may yield three million gallons if the recovery of the entire product is encouraged by the Government by fixing a fair selling price. The possibility of low temperature carbonisation of coal with a view to secure larger yields of ammonium sulphate, soda ash and phosphatic fertilisers in South India may possibly be established based on the local production of sea-salt, phosphates and gypsum of Trichinopoly and limestone of Tuticorin. India's resources of sulphur are poor; Surveys of Baluchistan sulphur deposits were disappointing and small deposits of pyrites are not dependable. Government can put up a small factory which will yield valuable data on the economics of sulphuric acid production from gypsum whose deposits in India are extensive and of high grade. Construction of a factory for producing 350 thousand tons ammonium sulphate using gypsum from N.W. India has been started and another factory with a capacity of 50,000 tons per annum is under construction near Cochin harbour using the gypsum of South India. Negotiations have been completed by the Tatas for starting a dystuff industry in India on a comprehensive scale in collaboration with the Imperial Chemical Industries. If the proposal for prohibiting export of ilmenite and monazite sands materialises, it is probable that industries based on these raw materials may be soon started in the Travancore State. Production of aluminium electrolytic copper, electric furnace steel, alloy steels, ferrochrome, ferrosilicon, etc., which was started on a small scale during the war will probably undergo rapid expansion in view of an assured market within the country itself.

In a paper entitled "Natural Products of the Empire and their utilisation", Dr. J. L. Simonsen considered the utilisation of natural products of the Empire from colonial aspects. The products may be divided into two classes —mineral (wasting) and agricultural and forest

* Review of Proceedings of the Empire Scientific Conference held in London, July 1946.

(growing) assets. In their utilisation water is of fundamental importance and an adequate survey of the water resources of the Empire is essential as man, stock and crop depend on water which also supplies power and heat when suitably sited. This important aspect of the future industrial development has been fully recognised in India which has remained a pioneer in the study of problems of irrigation. Consideration might be given to the processing of the mineral ores, *viz.*, bauxite deposits of the Gold Coast and Eritish Guiana in the Colonies themselves as is being done in the Dominions and India. Rich ores of metals like lead and tin are being rapidly exhausted and a fruitful field may lie in the prospecting for new sources of low-grade ores and finding improved methods for their utilisation. The prosperity of the Colonial Empire depends on the efficiency of its main industry, namely, agriculture, which requires to be maintained at a high level. There is considerable scope for the introduction of improved methods in the treatment of sugar-cane and new industrial uses for sugar must be found out apart from its uses for nutrition and in fermentation industries. It is essential to re-examine the main starch yielding plants for the difference in the character of the starches as recent researches on the separation of the two constituents of starch suggest new technical uses. Use of alcohol as a motor fuel must be encouraged. Fermentation industries which use molasses as the raw material may also be of importance. Working up oil seeds in the colonies exporting only the oil and using the cake locally, should be investigated. Afforestation of suitable areas with pines might provide valuable Empire sources of turpentine and rosin. Manufacture of vanillin from lignin and guaicol endangers zanzibar clove oil industry and it is urgently necessary to find new uses for the clove oil. Development of minor forest products like lac, cashew-nut oil, gums, insecticidal and medicinal plants should be undertaken. The fruit industry could be encouraged and greater attention paid to the possibilities of industries based on livestock and fisheries.

Prof. E. J. Hartung dealt with the utilisation of some of the natural products of Australia excluding minerals and coal. The average annual Australian clip of wool contains about 80,000 tons of wool-wax and 30,000 tons of suint. In the wool scoured in Australia at present, 15,000 tons of wool-wax are potentially available out of which only 450 tons are saved, and the associated 5,000 tons of suint are wholly lost. A thorough investigation is being undertaken to find other uses for these bye-products of the wool industry. Wool-waste itself can be used as a raw material to produce protein hydrolysates, synthetic fibres, plastics or fertilisers. Trees of the genus eucalyptus are predominant in Australia and Tasmania and are capable of yielding large amounts of wood-pulp, lignin and eucalyptus oil. Methods can be developed for obtaining good yields of pulp and furfural from wheat straw which, at present, is being used to produce semi-chemical pulp for straw board. Oat hulls, cotton-seed hulls, maize cobs, and hard wood saw dust can be utilised for making furfural. Most of the sugar produced in Australia is used as food. Apart from its use as a source of alcohol there may not be much scope for expanding the use of Australian molasses for making solvents. The outlook on sugarcane wax is not promising. Large quantities of bagasse which are, at present, being used for making light wall-boards and for the generation of power, may possibly be used to provide long-fibred pulp for mixing with short-fibred pulps from Australian hard woods. Fellmongery trimmings are processed to recover the wool and for making glue and gelatine. Processing of offals for animal feeds and organic manures, have been established and production of shark-liver oil rich in vitamin A has reached good proportions. Full potentialities of Australian fisheries are not known, but air surveys have given promising indications; development must, however, proceed on lines different from those which have been successful in European waters. During the war investigations showed that a number of coastal weeds of Australia could be used for agar manufacture and in particular *Gracilaria confervoides* from New South Wales waters might furnish a 50 per cent. yield on the dried weed basis. The present annual output of 24 tons agar could be increased to 100 tons. There is also the possibility of establishing the manufacture of alginates from the weed macrocystis in view of the varied uses to which the alginates were put during the war.

"Review of some Natural Products of the Union of South Africa and the Industries that are or might be based on them", contributed by Dr. H. J. Van Eck, gives a survey of the raw materials available in South Africa. The best basis for developing resources is to direct all productive effort in accordance with the country's comparative advantages. The mineral resources are discussed with particular emphasis on iron, manganese and chromium ores, with the developments that have already been made in the iron and steel industry the production of stainless steels may be of importance because of the Union's favourable position. The large and cheap deposits of coal in the Union, which form the source of electricity, should in future play an important part as a raw material in the chemical industry and also become potential oil fields. The fact that some exotic trees grow faster in South Africa than in most other countries whose chemical industries are used on the sugar industry, underlines the possibilities of masonite, paper and cellulose if adequate water-supplies can be made available. There are also possibilities of developing cotton and woollen textiles. The Union has some great natural advantages but is deficient in some other directions; yet greater all-round progress can be made if a closer collaboration with other African territories in the matter of an interchange of materials can be established.

D. V. James Melville discussed the natural products (biological) of New Zealand and the chemical industries that are or might be based on them. Butter and cheese account for over 50 per cent. of the value of New Zealand's exports. Even though chemical methods of control are used on these industries they can

by no means be termed chemical industries. Attention must, therefore, be directed to the by-products of butter and cheese manufacture, *viz.*, skim-milk and whey and their utilisation in special ways. Not more than 5 per cent. of the total skim-milk produced in New Zealand is dried, the rest being used as pig feed. Efficiency of conversion of milk solids into pig flesh is low and high-grade proteins are wasted in the process. The technical problems of utilising skim-milk are connected with dehydration and storage which will allow of entirely satisfactory reconstruction, marketing in areas of low purchasing power with the best methods of addition to the protein-poor diets of such areas. Uneconomic utilisation of whey also leads to a large overall loss of high-grade proteins. The New Zealand process of manufacturing lactose from whey is technically efficient. Due to the expansion in the world market for lactose during the past three years, largely in connection with the manufacture of penicillin, the present prospects for the industry appear bright. The concentrated mother liquor left over after recovering lactose are now used entirely as stock feed. Nothing promising has emerged from the work done towards a more economic utilisation of this product. Production of casein from skim-milk is strictly controlled due to the demand for pig meat by the United Kingdom and the consequent necessity for retaining skim-milk for pig feeding. Casein is likely to hold its own as an adhesive in plywood manufacture and while there is a field for some expansion in casein plastics there is a constant threat from synthetic resins and plastics. Among the by-products of the meat industry prospects for rennet production in the post-war period are encouraging and the current economic policy furnishes the leather and hides industry an assured internal market. A sound gelatin industry which is now operating, can offer adequate supplies of raw glands, particularly the pancreas and the pituitary, for the preparation of hormones in New Zealand itself. A more economic use of blood than its conversion into fertiliser is a major piece of investigation in which New Zealand is particularly interested. Fish liver oils and sea-weed products such as agar and alginic acids appear to have real potentialities. Tree growth in New Zealand is rapid and her exotic forests can be greatly extended. More efficient utilisation of the products of the timber and pulping industries is an urgent problem facing New Zealand in common with all timber producing countries of the world and justifies considerable expenditure on research work. In view of the natural advantages possessed by the New Zealand flax plant, *Phormium tenax*, in high fibre yield per acre, intense investigation on the plant and its fibres which have been hitherto sporadic, is fully warranted. The phormium fibre cannot be utilised for rayon manufacture but a high-grade paper can be made from it. The small tobacco industry of the country provides enough waste material and there seems no reason why about half of the country's needs of nicotine should not be obtained from locally grown tobacco. The war-time enterprises of successfully growing on small areas *Digitalis purpurea, Dattura stramonium, Belladorna and Hyoscyamus* for home consumption and foreign export, deserve to be consolidated during the post-war era, since inquiries for further supplies of the drugs have been received from both English and Australian firms.

## ON PHYSICAL ANALOGY—ITS USEFULNESS AND ITS DANGERS

By D. FERROLI, S.J., D.SC.

### Introduction

CURIOSITY is the beginning of Science. Curiosity leads to *observation*, which studies facts, follows their development, inquires into their origin. After observation comes *classification*, whereby facts are arranged into various categories, according to their similarity or otherwise. A third step may be described as *formulation*, when the *law*, which is suspected to underlie the uniformity with which facts present themselves, is given a succinct verbal shape, to be—whenever possible—expressed by a mathematical formula. But the formula is—by its very nature—universal, and must be verified; i.e., formulation demands *verification*, which is obviously done by further observation and experiment.

### 2. The Main Scope of Analogy in Physics is Explained by Means of an Example

To guide the physicist to develop his ideas, without committing himself to a definite theory, *Analogy* plays a most important part. By *Physical Analogy* we understand—with Clerk Maxwell—"that partial similarity between the laws of one science and those of another, which makes each one of them illustrate the other".

When the study of *Solutions* was first undertaken, and the main facts observed and classified, it became soon apparent that the solute existed in the solvent in most minute particles, which seemed to be in continual agitation. The question was soon asked: May not these particles behave in the solvent, as the particles of a gas behave in a closed vessel?

If that was so, the *Kinetic Theory of Gases*, so magnificently built up by the genius of Clausius, Maxwell and Boltzmann could perhaps be used to illustrate the behaviour of solutions. The suspected *Analogy* might also, eventually, lead to the discovery and formulation of a law. Now the first formula of the Kinetic Theory embodies the Laws of Boyle-Mariotte and of Charles. Could a similar formula be applied to solutions?

As is well known, Pfeffer found that, in the case of dilute cane sugar solutions the osmotic pressure, at a given temperature, is nearly proportional to concentration. Also, the osmotic pressure, for a given concentration, is proportional to the absolute temperature,

This, of course, means that the Laws of Gases hold also for dilute solutions, and Van't Hoff left justified in asserting that the osmotic pressure of a solution is equal to the gas pressure which the solute would exert if all the solvents were removed, and the dissolved substances were left in the space in the condition of an ideal gas.

In this case similar, or analogous behaviour was first suspected. Experiment proved the suspicion to be correct. But it was Analogy which dictated the experiments, and showed the path which the scientist had to choose among an infinity of alternatives, if he was to put some order in his notions of solutions, and formulate some Law which might be a convenient indication of their behaviour.

### 3. A Remark

But in this way, did not Analogy limit the scientist's vision, and lead to forced conclusions?

Obviously it did limit his vision; but, paradoxically, it is only by limiting our field of view that we achieve success. A scientist, who attempts to embrace all, will grasp nothing. There is no concentration without limitation, and by concentration we gain in depth, if we loose in extension. Further, orientation imposes limitations; but research lacking orientation will prove futile.

### 4. A Danger

But might not Van't Hoff's bold formulation prove deceptive? Might not similarity of terms cover very dissimilar things? The possibility cannot be denied, and it appeared very real as soon as scientists tried to identify osmotic pressure with the molecular bombardment by the particles of the solute. Besides, an Analogy was asserted between the solvent and an empty vessel. But how can a solvent be assimilated to a vacuum? Are the interstices between the particles of the solvent so great in comparison with the molecules of the solute, as to allow a certain plausibility to the view that the behaviour of particles in dilute solutions is analogous to the behaviour of gaseous particles *in vacuo*?

Yet Boltzmann showed that, on the assumption that the *Law of Equipartition of Energy* holds for the solute, the laws of osmotic pressure necessarily followed. But scientists were somewhat suspicious of Boltzmann's mathematical methods as applied to solutions, for, in the words of Clerk-Maxwell, "the excessive use of Mathematics in Physics may make us lose sight of the phenomena to be explained; and though we may trace out the consequences of given laws, we can never obtain more extensive views of the connexions of the subject".

It is good to remember that mathematics—as applied to physics—systematizes, summarizes, simplifies, but does not, by itself, lead onwards. Progress is mainly due to Experiment and to Analogy.

### 5. Another Example

And Analogy led on Jean Perrin to study *Emulsions*, and see if the *Law of Equipartition of Energy*, which is the corner-stone of the Kinetic Theory, might hold for them also. Pfeffer had shown that a molecule of sugar, with some 40 atoms, acts like a molecule of hydrogen with only 2 atoms. Perrin went further, and surmised that there was no limit to the grouping of atoms, and that the law holds also when groups are so complex as to be visible to the microscope. Then, of course, a corpuscle, which takes part in the so-called *Brownian Movement*, and which consists of millions of atoms, ought to behave like a hydrogen molecule. If it is so, *Emulsions* obey the Laws of Gases, and it must be possible to determine *Avogadro's Constant* from their behaviour. Perrin's wonderful experiments led him to the determination of that very important number, his results lying between $60 \cdot 10^{22}$ and $70 \cdot 10^{22}$. A remarkable achievement indeed.

### 6. Caution

We shall digress a little, though, as it will be seen, the digression has a certain bearing on the matter in hand.

All will admit that there exists an Analogy between a map (say) and the country which it represents. From the map one can find distance, direction and orientation between two places. The map will tell us whether a district is hilly or not, wooded or cultivated, rich in water or rich in sand. Yet, how different is the knowledge of a country which we gather from a map, and the knowledge we acquire by visiting it. Map-knowledge—so to call it—is not to be despised, but it lacks life and fulness. Map-knowledge is not false; yet how poor and meagre, if unaccompanied by real knowledge.

The same may proportionately be said of the knowledge of one science gathered only from the Analogy with the Laws and formulæ of another science. The formulæ need not be false, but the knowledge they impart is meagre and inadequate. It must needs be filled up and implemented by experimental knowledge. The beginner is always under the danger of resting content when, either by Analogy, or by the free use of Hypothesis, or in some other way, he has given mathematical expression to a Law. To take an example from Clerk-Maxwell: "The Laws of uniform motion of heat in homogeneous media are mathematically identical with those of attractions varying inversely as the distance. Hence, if we knew nothing more than is expressed in the mathematical formulæ, there would be nothing to choose between one set of phenomena and the other". Similarly the Laws of Gases, of dilute solutions and of emulsions, are analogous. The formulæ which represent them are the same. Yet the difference is considerable.

### 7. A Third Example

As already remarked, *the Law of Equipartition of Energy* is the foundation of the Kinetic Theory of Gases. By a stroke of genius, Eddington extended the Law to the stars. Already in 1911 Halm had suspected a certain equality between the kinetic energies of light and heavy stars. In 1922 Seares showed that the surmised equality was real. Eddington then studied the problem of the distribution of density, pressure and temperature in the interior of a star. The forces coming into play are gravitation and the pressure of radiation. Observation furnished the data of mass, density and quantity of heat radiated by the star

in unit time. Owing to the exceedingly high temperatures and to the so-called *Photo-Electric Effect*, the atoms in the stars are dissociated and ionised. Now, by Analogy with perfect gases, the Thermo-dynamical Theory of Gibbs on the equilibrium of gaseous systems may be applied to the electronic dissociation in the stars. Eddington then worked out the formulæ which connect the mass of a star with its radius, its temperature and the quantity of energy which it radiates. For instance the temperature at the centre of the Sun is $4 \cdot 10^7$°C. and its pressure, $133 \cdot 10^7$ atmospheres. He found also that if the mass of the star is less than $10^{32}$ gms. the radiation pressure is very small in comparison with that due to matter. On the contrary, if the mass exceeds $10^{35}$, the material pressure may be neglected. From astronomical data he constructed his famous *Curve*, which afforded a sufficient test for his theory. But it proved something more.

In the beginning it was believed that Eddington's theories, founded as they are on the Laws of perfect gases, applied only to giant stars. For it seemed inconceivable that the Laws of Boyle and Gay-Lussac could be valid for stars with a density several times that of iron in their interior. But observation showed on the contrary that the properties of gases are to be applied to all the stars (*f.i.*, to *Capella*, whose density equals that of air, and to *Krueger*, sixty times as dense as iron). The thing was astounding. How an explanation was sought and found in the new ideas on the constitution and disintegration of atoms is most interesting, but it far exceeds the limits of the present article.

### 8. Conclusion

What has been said, however, is sufficient to show the fruitfulness of *Physical Analogy*. By *Analogy*, not only does the scientist systematize his knowledge; he further extends and develops it. *Analogy*, by suggesting the formulation of a Law, will direct the choice of experiments. No doubt, an injudicious use of *Analogy* may lead to a distorted view of nature. Also, merely analogical laws may result in knowledge that is formal and almost nominalistic. Experiment, however, will keep our feet firmly planted on Earth—which will eventually prove to be a spring board enabling the mind to fathom the innermost secrets of the stars.

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## TONUS IN STRIATED MUSCLE

By INDERJIT SINGH, F.A.SC., and Mrs. SUNITA INDERJIT SINGH

*(From the Physiological Laboratory, Dow Medical College, Karachi)*

THE mechanism by which a state of partial contraction of striated muscle, or tonus, is produced remains enigmatic. The explanation most generally accepted is that a rotational excitement of motor units occurs, one group being released as the next contracts.[1] The excitations would have to be properly timed in order to produce an even and imperceptible contraction as that of tonus. If this were true it would be expected that action potentials led from small aggregates would reveal rotational bursts of impulses. Such a phenomenon has not been capable of demonstration.[2]

Light on the tonic contraction of striated muscle is thrown by studies of similar contraction in unstriated muscle. The chief characteristics of tonic contraction of skeletal muscle are: (1) The metabolism (oxygen consumption and carbon dioxide output) is low when compared with that of muscle when executing movements; it is only about 25 per cent. higher than that of completely paralysed muscle. Posturing muscle is also relatively infatiguable; the deverbrate cat may stand for six days without signs of exhaustion. A small (needle) electrode placed into a muscle unit, shows that it contracts synchronously but responds at a low frequency, i.e., 5-20 per second indicating a correspondingly low rate of discharge from the anterior horn cells.[3] The tension exerted is far smaller than that given by the same muscle when it is stimulated at a high rate (*e.g.*, 100 times per second) through its motor nerve.

Skeletal muscle contains red fibres, rich in sarcoplasm, poorly marked transverse striations and nuclei scattered throughout the substance of the fibres. They contract slowly after a long latency, the duration of contraction being three times that of the more quickly acting and more highly differentiated pale fibres. Red muscles go into tetanus at a low rate of 5 to 8 stimuli per second.[4]

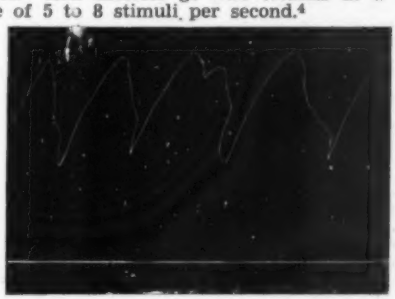

FIG. 1. Mytilus muscle in saline with 0·02 M $Ca Cl_2$; Barium 0·07 M $Ba Cl_2$

Now, let us compare the above facts in striated muscle with those in unstriated muscle. Unstriated muscle can be tetanised if stimulated at a much lower frequency than striated muscle; various unstriated muscles in the body may differ in this respect, just as red and pale skeletal fibres. The metabolism of tonic contraction is lower than that of twitch contraction.[5] If *Mytilus muscle* is

immersed in a solution containing barium, it passes into a tonic contraction which is maintained by the muscle contracting periodically. Barium, though continuously present in the saline, appears to produce an intermittent stimulation. An interesting feature is that the frequency of stimulation automatically adjusts itself depending upon the slowness of relaxation; as expected the frequency is less, the slower the relaxation. Further the state of the muscle can be changed by varying the calcium concentration of the saline. If the concentration of calcium is high, then the relaxation is more rapid and the frequency greater than if the calcium content is low (Fig. 1).

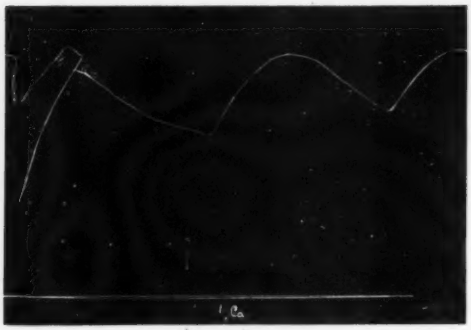

FIG. 2. Same muscle in 0·01 M $CaCl_2$

If the muscle is contracting at a low frequency, it is practically unfatiguable. Thus for tonic contraction, stimulation at a low frequency is required.

FIG. 3. Same muscle in 0·005 M $CaCl_2$

The above experiments on unstriated muscle show phenomena of tonic contraction which are very similar to those in striated muscle, and suggest that the tonic contractions in the two kinds of muscles are similar. The explanation which has been suggested for the former would, therefore, also apply to the latter.[6] It is probable that in striated muscle the same fibres subserve both twitch and tonic contractions, though differentiation has occurred into

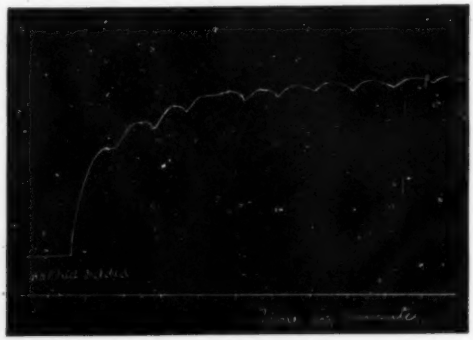

FIG. 4. Another muscle in 0·01 M $CaCl_2$

red and pale fibres in skeletal muscles, just as it has occurred in muscle in general into striated and unstriated ones. By some action it is probable that the state of skeletal muscle fibres is varied when they have to contract tonically or quickly. That isolated skeletal muscle is always in a state of partial, though minute contraction has been shown recently.[7] There is no reason why there should not be a variation in the magnitude of this contractile state. The twitch and the tonic contractions may be part of same contraction "spectrum"; as shown, the contractions of cardiac muscle would also fit into the same spectrum.[8] The various components of this "spectrum" may be linked as follows, though there may be some overlapping.

Striated muscle of insects (about 300 contractions/sec.) → slower striated muscle of other animals; pale fibres in twitch contraction (about 100/sec.) → pale fibres in tonic contraction (about 20/sec.) → red fibres (about 10/sec.) → cardiac fibres (about 70/min.) → quickly contracting (about 2/min.).

Unstriated muscle → tonic contraction of some unstriated muscle (about 1/10 min.) → tonic contraction of extremely slowly contracting unstriated muscle (about 1/30-60 min.).

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1. Forbes, *Arch. Neurol. and Psychiat.*, 1929, **22,** 247; Cobb and Wolff, *Ibid.*, 1933, **28,** 661. 2. Smith, *Amer. Jour. Physiol*, 1930. **108,** 639; Lindsay, *Ibid.*, 1935, **114,** 90; Wiggers, C. J., *Physiology in Health and Disease*, London, 1944. 3. Adrian and Bronk, *J. Physiol.*, 1929; Wright, Sampson, *Applied Physiology*, London, 1945. 4. McDowall, R. J. S., *Handbook of Physiology*, London, 1944. 5. Rao, S., and Singh, I., *J. Physiology*, 1940, **98,** 12. 6. Singh, I. and Mrs. Singh, I., *Proc. Ind. Acad. Sci*, 1946, **23,** 312. 7. Sandow, A., *Ann. N. Y. Acad. Sci.*, 1945, **46,** 153; Singh, I., *Curr. Sci.*, 1946, **15,** 57. 8. Singh, I., *J. Physiol.*, 1938, **91,** 322.

## TUBERCULOSIS IN INDIA*

THE Seventh Annual Report of the Tuberculosis Association of India for the year 1945, records another year of its useful work for the prevention, control and relief of tuberculosis in India. The factors which have hampered the progress of work of the Association since its inception still continue, but with the cessation of the war, it is hoped that considerable amount of energy which was so far mobilised in the country's war effort will now be diverted towards fighting the menace of India's "public enemy No. 2", tuberculosis.

In spite of all the difficulties that stood in the way, the Association, during the year under report, has been able not only to consolidate the work already started, but also to make considerable progress in new directions. There are at present 124 tuberculosis clinics and 70 tuberculosis hospitals and sanatoria with a total of 4,384 beds. The Government of Bengal is contemplating the opening of two tuberculosis sanatoria of 500 beds each in the Presidency. It is expected that the Government of Bombay and Bombay Municipality will complete two more clinics in near future. A tuberculosis sanatorium is being constructed at Ranchi by the Marwari Relief Association, Calcutta.

Under the auspices of the Central Association, Post-Graduate Refresher Course has been organised in different parts of the country. Two such courses were organised in Lahore and Madras during 1945; 32 doctors in all have received post-graduate training. It is the intention of the Association to organise similar courses at frequent intervals. Training of Health Visitors has also been undertaken. The course which commenced in October 1944, terminated in June 1945. Out of seven candidates who received instructions, four have been successful. Twelve candidates are, at present, receiving training. So far, New Delhi Tuberculosis Clinics and Lady Linlithgow Sanatorium, Kasauli, had been giving such training, but it is hoped that other affiliated associations will arrange in due course, to train this class of workers within their own provinces. The Association has also continued to afford training to a limited number of doctors at the Lady Linlithgow Sanatorium and New Delhi Tuberculosis Clinics. The Association has also decided to take suitable candidates at the Lady Linlithgow Sanatorium for training in the field of nursing.

The Madras Tuberculosis Diseases Diploma Course continues to be popular. The Mysore T.D.D. Course was started in June 1945 and it is expected that the Calcutta University will institute a similar course in the near future.

Dr. P. V. Benjamin has acted as Technical Adviser throughout the year and has devoted a considerable portion of his time to the affairs of the Association. He undertook an extensive tour in Western and Northern India and visited several centres to tender expert advice.

The full development of the Publicity and Propaganda Section has unfortunately been hampered to a great extent, but it is hoped that with the end of the war, more facilities will be available for the expansion of this section. In the meantime activities were carried on, by means of pamphlets, charts and other useful materials. Regarding the outlet for scientific papers on the subject, the Association has been labouring under serious handicap. *The Indian Medical Gazette* had been publishing Special Tuberculosis Number for the past eight years, but there are now difficulties in the continuation of this arrangement. The Association feels that at this stage, it should have a journal of its own, and it is expected that a journal predominantly of a clinical nature will be started after the next conference of the tuberculosis workers.

During the year under review, the Lady Linlithgow Sanatorium has carried on very useful work. The increasing progress and success of the Sanatorium can be judged from the receipt and payment account which appears in the Appendix. The activities of the New Delhi Tuberculosis Clinics in 1945, as in the previous years, represent a stage in the development of the propaganda, treatment and survey method of control of tuberculosis. The Clinics continued to function as a demonstration centre for diagnosis, treatment, care and after-care of patients, educative and preventive activities in the tubercular homes and a training centre for tuberculosis workers. Summaries of the reports of the Provincial and State Tuberculosis Associations appear in Appendix IX. The reports show that these Associations have concentrated their efforts on the training of tuberculosis workers and anti-tuberculosis propaganda and that a uniform progress has been maintained throughout the year.

N. N. De.

* Seventh Annual Report, 1945—The Tuberculosis Association of India. (Published by the Tuberculosis Association of India, New Delhi.)

## V-2 ROCKETS TO RECORD SUN'S ULTRAVIOLET RAYS

FILMS developed by Eastman Kodak Co. with special fluorescent coatings will be used in spectrographs mounted in the noses of V-2 rockets. Ultraviolet sunlight, unable to penetrate either our atmosphere or ordinary photographic emulsions, will be recorded when the rockets reach altitudes of about 100 miles. The fluorescent film coating glows when ultraviolet light strikes it, and the glow is recorded on the film.

—(*Courtesy of "Sky and Telescope,"* August 1946, p. 10.)

# LETTERS TO THE EDITOR


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## GEOMAGNETIC TIME VARIATIONS AND THEIR RELATION TO IONOSPHERIC CONDITIONS

BESIDES the secular variation of the geomagnetic field there are other time variations of which, for equatorial stations the solar diurnal variation is the most important which is believed to originate in the earth's outer atmosphere or in the Ionosphere. The quiet day solar diurnal variation $S_q$ is generally derived from the records of the five International Quiet days per month. From a comparison of these curves for different observatories it is possible to study the variation of the Ionospheric currents with the geographical and geomagnetic co-ordinates. It is believed that the $S_q$ variation depends on geographical latitude and local time. The purpose of the present note is to show that, whereas this may be true for stations in high latitudes, the $S_q$ curves for stations at low but equal geographical latitudes, differ widely both in intensity as well as in type. In Fig. 1, I have drawn the average $S_q$ curves of H for Alibag ($\phi = 18{\cdot}6$, $\lambda = 72{\cdot}9$, $\psi = 9{\cdot}5$) for the equinoctial season, for the years around the sunspot maximum (1926-1929), where $\phi$, $\lambda$, $\psi$ are the geocentric latitude, longitude and the geomagnetic latitude respectively; together with the similar curves for San Juan ($\phi = 18{\cdot}4$, $\lambda = 293{\cdot}9$, $\psi = 29{\cdot}9$) and Huancayo ($\phi = -12{\cdot}0$, $\lambda = 284{\cdot}7$, $\psi = -0{\cdot}6$) as given by Bartels[1] and others. $S_q$ curves also

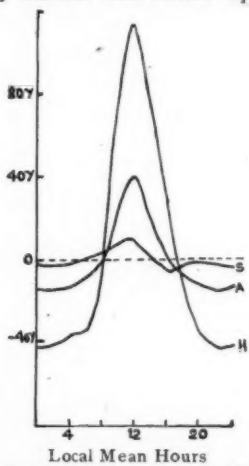


FIG. 1. Average $S_q$ curves for San Juan (S), Alibag (A) and Huancayo (H).

vary with season and sunspot number, the variation, however, occurs in intensity, but the

type is more or less similar. This was also shown by Moos[2] from an analysis of the Bombay records for the years 1894-1904. It appears that the diurnal range at Alibag is about *four* times that of San Juan and the types of the curves are also dissimilar, and in particular the evening sharp minimum at San Juan, which falls below the mean night level, is not at all visible at Alibag. When compared with Huancayo it is evident that the $S_q$ curves at Alibag and Huancayo are similar in type though the Huancayo range is much greater than that at Alibag. The type of the Alibag curve suggests that the $S_q$ curves for Kodaikanal will possibly be similar to that at Huancayo, both in intensity and type. The analysis of Schmidt show that the different harmonics in the solar diurnal variation of H at Bombay and Singapore ($\phi = 1{\cdot}3$, $\lambda = 103{\cdot}6$, $\psi = -210{\cdot}1$) are similar both in amplitude and phase, though the values of $\phi$ at those stations differ widely. On the other hand the $S_q$ curves for Potsdam and Irkutsk are similar, though the values of $\psi$ for these stations differ. The above anomalies indicate a geomagnetic control of $S_q$ variations for low latitude stations although for high latitude stations it is more dependent on geographical co-ordinates.

According to the Dynamo theory, $S_q$ is produced by the Ionospheric currents which, however, is governed mainly by the atmospheric conductivity K and the daily convection currents. It is quite possible that the latter depends only on the sun's zenith distance, and so the above anomalies can be explained if K is supposed to vary with $\psi$, particularly for low latitudes. Appleton[3] has recently shown that the maximum noon ionization density in the $F_2$ layer depends on the geomagnetic co-ordinates. In view of the arguments given above it is quite probable that, at least for low latitudes, K does not depend on the zenith distance of the sun as has always been assumed so far, and that the probable seat of the $S_q$ current system is in the $F_2$ layer. It should be noted that $S_q$ depends on the integrated conductivity of the conducting layer, whereas the maximum ionization density depends critically on the heating effects associated with the ionization and the consequent variation in the thickness of the layer, which is larger in the $F_2$ layer as compared to that in the E and $F_1$ layers. Consequently it is quite probable that although K increases as one approaches the magnetic equator, the maximum noon ionization density, after an initial rise diminishes to a low value at the magnetic equator. This fall is probably due to the heating and expansion in the $F_2$ layer and is further accentuated by the "bite out" effect in the diurnal curve of maximum ion density. The $fF_2$ curves[4] show that as at Huancayo the "bite out" effect exists also at Madras though it is absent at Delhi.

Alibag Observatory,
Bombay, S. K. CHAKRABARTY.
*August* 8, 1946.

1. Bartels and Johnston, *Terr. Mag.*, 1939, **44**, 455. 2. Moos, *Colaba Magnetic Data*, Part II, 200. 3. Appleton, *Nature*, 1946, **157**, 691. 4. *Ionospheric Data* (published by A.I.R., Delhi), 1946, **2**, 4.

## A NEW FIND OF FOSSILS IN VINDHYAN ROCKS OF ROHTAS HILLS IN BIHAR

A FEW months back while on an inspection of the limestone quarries about 15 miles southwest of Dehri-on-Sone (E.I.R.) in the company of Mr. R. S. Singh, M.SC., the author picked up a few slabs of limestone which carried some peculiar structures. On previous occasions similar finds from the same quarry were passed off as possibly inorganic concretions or solution structures and were neglected. On this occasion, however, the structures observed had such a regularity in form though different in sizes and had such a strong resemblance to some known primitive molluscan fossils that they deserved a very careful examination.

One limestone slab carried on one side four shell-like structures of different sizes ranging from half an inch to nearly two inches in length, all conical in shape, broad at one end and gradually tapering at the other with a semicircular cross-section. The broader end shows an abrupt though inclined termination the slope of which bears a constant angle in all the specimens. This sloping terminal end is somewhat worn out in three specimens but one has a layered lid-like structure. The main body of the specimens is distinctly striated transversely.

Besides these four shell-like structures the same limestone slab also carries three depressed impressions which are incomplete but what little is preserved shows that they are impressions of similar shell-like structures and represent the plane face of the body (Fig. 1).

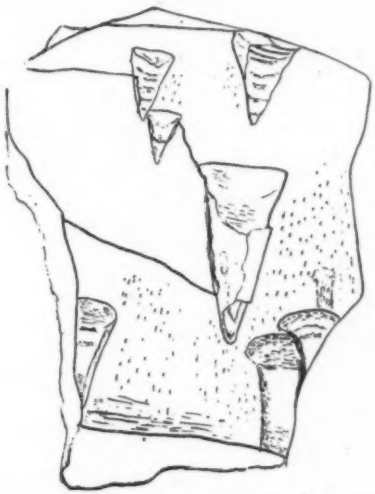

FIG. 1. Vindhyan limestone with shells and impressions of *Hyolithes rohitaswei* sp. nov. × ·5.

In addition to these large-scale structures the slab also carries a swarm of minute elongated bodies each slightly bulging in the

middle and tapering at the ends. They are lying on the slab with a distinct parallelism among themselves as well as with the larger conical bodies. One very striking characteristic of these minute bodies is that their lower end is in every case distinctly darker than the rest of the body. This shows that these minute bodies probably represent the early larval stages of the same organism as is represented by the large conical shells.

These shell-like structures have a shape already too exceptional for concretions whereas the constancy of other characters makes it difficult to conceive that the structures could be of inorganic origin unless Nature is out to produce deceptive appearances. These shells on the other hand have a strong resemblance to certain Pteropods which are typical of early Palæozoic life. The various characters noted above are all characteristic of the genus Hyolithes which has a range from Cambrian to Permian. This genus is already recorded from the Neobolus beds of the Salt Range, from the Upper Hymantas (Middle to Upper Cambrian) of Kashmir and of Spiti and also from the Ordovician of Burma.

As for the life during the Vindhyan Period it had always been a matter of surprise that the rocks of the period though very well suited to preserve the life-forms are so completely devoid of any recognisable fossil remains. However, some discoidal bodies were obtained on a number of occasions and have been lately described by Chapman as belonging to Atrematous Brachiopods and creating a new genus 'Fermoria' to receive them. Dr. M. R. Sahni, however, doubts their Brachiopod affinities though he also believes in their organic nature.

These fossils described by Chapman under the generic term Fermoria all come from Suket Shales of Neemuch and Rampura in Central India, from a horizon near the junction of Lower and Upper Vindhyans.

The present collection from the Rohtas Hills also contains a number of discoidal remains which have a strong resemblance to Brachiopods of the Orthis type whereas there are others which are distinctly inequilateral and may belong to some primitive Lamellibranch. A systematic study of these is yet to be undertaken. The present collection comes from a band of limestone near the top of the Rohtas Stage which is the youngest of the Semri Series or the Lower Vindhyan formation. Thus the two fossil horizons are at the transition of the Lower and the Upper Vindhyan systems and as such are approximately homotaxial.

This introduces a great plausibility that the conical and discoidal bodies in this collection are fossil remains belonging to the earliest molluscan types.

The conical remains described above are easily preferable to the Pteropod genus Hyolithes and as figured below has been named *Hyolithes rohitaswei* sp. nov. from its occurrence in Rohitas Hills. Its specific characters may be described as follows:—

*Hyolithes rohitaswei* sp. nov.—Shell symmetrical, conical, straight, cross-section plano-convex, attached to the rock along flat face which bears numerous transverse striæ at the anterior end but is nearly smooth in its posterior part; the curved face distinctly striated transversely some of the striæ being deeper and more prominent than others giving a septate form, the anterior end with an abrupt though inclined termination with a definite slope; aperture completely closed by an operculum semi-circular in outline and with layered structure. Occurrence: Top zone of Rohtas Stage of the Semri (or Lower Vindhyan) Series. Locality: Three miles west of Ramdhera on Sone R.S. (D.R.L.R.) in Shahbad district, Bihar.

The age of the Vindhyans on the basis of these fossil remains appears Lower Palæozoic and is very likely Cambrian.

Dalmianagar, K. P. Rode.
*September* 3, 1946.

## A NEW ANTI-ALLERGIC SERUM

Allergic reactions, which appear in man after injection of horse serum, are believed to be manifestations of antigen-antibody reactions. These reactions would, therefore, be prevented if either of the reagents could be inactivated.

Enzymic treatments[1,2] of horse serum proteins appear to reduce their specific antigenicity. Since the enzyme-treated immune horse serum globulins have been brought into use in man, the incidence of serum reactions is reported to have been significantly less than usual; A large part of the immune bodies is, however, lost during enzymic treatment and subsequent processing. Hence, the cost of production of the therapeutic serum is considerably increased.

The alternative method of preventing serum reactions by inactivating the antibody has given satisfactory results. In this method, antibodies to the human serum proteins are used to inactivate the antibody which is responsible for serum reactions. For this purpose, anti-human serum is prepared in horses. Horses are injected intravenously every fifth day with pooled human serum of doses which gradually decrease from 250 ml. to 25 ml. The serum of such horses contains complement fixing antibodies to human serum proteins, and inhibits appearance of serum reactions in man. Thus, the same serum, which contains the antigen which is responsible for the serum reactions, also contains the protective substance which inhibits serum reactions presumably by inactivating the antibody.

The anti-human serum has not shown any untoward effects in man. It is, therefore, quite safe to use this serum in man for the prevention or inhibition of allergic reactions. The very simplicity of the method of preparation of this serum, and the absolute safety in its proper use, make the procedure eminently suitable for application in man.

Dept. of Antitoxins and Sera,
Haffkine Institute, D. C. Lahiri.
Bombay,
*August* 14, 1946.

1. Pope, C. G., *Brit. Jour. Exp. Path.*, 1938, **19**, 245.
2. Coghill, R. D., Fell. N., Creighton, M., and Brown, G., *J. Immunol.*, 1940, **39**, 207.

## THE SOURCE OF CARBON AS A DETERMINANT IN DIASTASE-FORMATION BY *ASP. ORYZAE*

As a natural sequence to our studies on the influence of the nature of nitrogen in diastase-formation,[1,2] a study of the role of carbohydrates in diastase formation by *Asp. oryzæ* was taken up. The literature on this subject is meagre and though a certain amount of work has been done by Saito[3] and by Funke,[4] no details are available regarding the comparative diastase forming efficiency of the various forms of carbohydrates. The following is an attempt to determine the relative efficiencies of a group of the more commonly available carbohydrates in stimulating diastase-production by *A. oryzæ*.

EXPERIMENTAL

The carbohydrates used are arabinose, xylose, galactose, glucose, mannose, lactose, maltose, sucrose, raffinose, inulin and starch. The nitrogen source for the organism was potassium nitrate. The salt mixture was composed of $KH_2PO_4$—2·5 gms., $MgSO_4.7H_2O$—0·5 gm., $CaCl_2.2H_2O$—0·5 gm., $ZnSO_4$—0·025 gm., $FeSO_4.7H_2O$—0·0'5 gm. (dissolved in water, enough HCl added to dissolve the precipitate and volume made up to 250 c.c.).

The composition of the media was as follows: Carbohydrate equivalent to 20 mg. carbon; $KNO_3$ equivalent to 2 mg. nitrogen; salt solution 0·5 c.c.

Final pH adjusted to 6·5 and vol. made upto 4 c.c. in each case. The method of growing the fungus[5] and the determination of the diastatic activity of the extracts[6] are the same as described previously. The results are given below:—

TABLE I

*Total Activity of the Extracts in Lintner Units*

| Carbohydrate | Arabinose | Xylose | Galactose | Glucose | Mannose | Lactose |
|---|---|---|---|---|---|---|
| Total Activity (L.U.) | 23·1 | 31·9 | 28·8 | 127·9 | 19·6 | 15·7 |

| Carbohydrate | Maltose | Sucrose | Raffinose | Inulin | Starch |
|---|---|---|---|---|---|
| Total Activity (L.U.) | 282·4 | 53·2 | 45·9 | 6·9 | 280·0 |

DISCUSSION AND CONCLUSIONS

The results show that starch and its hydrolytic products, glucose and maltose, are prominent as diastase producers. The other carbohydrates are not efficient in stimulating diastase-formation, the lævorotatory inulin being the poorest. The same phenomenon of increased diastase-production by starch, maltose and glucose in the case of *Asp. niger* has been observed by Funke.[7] Only slight growths were obtained in the case of arabinose, lactose, mannose and inulin; a better growth was, however, secured with raffinose, galactose and xylose as the source of carbon. Sucrose gave rise to a fairly good growth, but in the case of maltose, glucose and starch there was abundant growth.

The increased diastase production by *Asp. oryzæ* with maltose and starch as carbon sources is in accordance with Yudkin's "mass action theory of enzyme formation,"[8] which postulates the mediation of a precursor for the elaboration of adaptative enzyme. The precursor which in the cell may be quite a negligible amount is supposed to be in equilibrium with the enzyme. The addition of the precursor, usually the substrate or its hydrolytic intermediaries, will shift the equilibrium in favour of an increase in the concentration of the enzyme.

M. R. RAGHAVENDRA RAO.
M. SREENIVASAYA.

Section of Fermentation Technology,
Indian Institute of Science,
Bangalore,
*July* 23, 1946.

1. Bindal, A. N., and Sreenivasaya, M., *J. Sci. and Ind. Res.*, 1945, **3**, 386. 2. Raghavendra Rao, M. R., and Sreenivasaya, M., *Ibid.*, 1946, **4**, 654. 3. Saito, K., *C.A.*, 1911, **2**, 707. 4. Funke, *Ibid.*, 1929 **28**, 4489. 5. Raghavendra Rao, M. R., and Sreenivasaya, M., *Curr. Sci.*, 1946. 6. Bindal, A. N., and Sreenivasaya, M., *J. Sci. and Ind. Res.*, 1944, **3**, 245. 7. Funke, G. L., *Zbl. Bakt.*, 1923, **59**, 162. 8. Yudkin, J., *Biol. Revs.*, 1938, **13**, 93.

## REACTIONS BETWEEN IODINE AND SODIUM SALTS OF CARBOXYLIC ACIDS IN PRESENCE OF METAL IONS AS CATALYST

(i) *Photo-reactions*—

A STUDY of reactions between iodine (dissolved in KI) and sodium salts of the following carboxylic acids in light (illuminated by 1000-watt lamp) indicates that contrary to the observations of Dhar and co-workers[1,2] and unlike the potassium oxalate iodine reaction, these reactions proceed with negligibly low velocity at room temperatures (about 20°-40° C.) provided the reactants used are pure and precautions are taken to account for the loss of iodine by evaporation. The acids examined are: Acetic, Propionic, Butyric, Succinic, Malic, Benzoic, Phthalic, Glycollic, Lactic, Malic, Tartaric, Citric, Mandelic and Glyceric.

Further, it is found that addition of traces of certain metallic ions like Mn (II), Cr (III), Fe (III), Co (II), $UO_2$ (II), and Ce (III) promotes reactions with salts of hydroxycarboxylic acids to varying degrees. Out of these Mn (II) and Cr (III) are most effective in all cases. The carboxylic acids containing no -OH group, however, do not react in light in the presence of added catalysts with the exception of Mn (II) which is oxidised to $MnO_2$ and hence precipitated. The factors which influence the reaction rates are many; thus increase of $[H]^+$ ultimately suppresses the reaction, whereas withdrawal of $I_2$ in the equil-

ibrium $I' + I_2 \rightleftarrows I'_2$, as the amount of I' present progressively increases in the course of reaction, renders kinetic interpretation difficult. Moreover, in some reactions solid iodination products appear, which effectively rules out photochemical measurements for the purposes of determining the order of reaction, quantum yield, etc. There are a number of other complications, the details of which together with a probable mechanism of reaction based on the formation of co-ordination compounds will shortly appear in the *Journal of Indian Chemical Society*.

(ii) *Dark reactions*—

As expected from the behaviour of photoreactions, no reaction takes place in the dark between salts of non-hydroxycarboxylic acids and iodine even in the presence of catalysts excepting Mn (II) which is very slowly oxidised and precipitated as $MnO_2$.

The reactions with salts of hydroxycarboxylic acids (mentioned above) are very slowly catalysed in the dark by some of the metallic ions specially Mn (II) and Cr (III) and also by Co (II) in some cases. No appreciable change takes place within the first ten to twelve hours, hence it was at first thought that there was no dark reaction at all and so reported in a preliminary communication.[3] Detailed investigation has shown that dark reactions do take place extremely slowly, and in some cases it takes a few weeks for completion of the reaction at the room temperature. Recently Qureshi and Veeriah[4] have reported similar observations in the case of sodium citrate-iodine reaction pointing out the existence of what may be called an "induction period". In the cases tried in this investigation long "induction periods" have been observed in dark reactions specially with those of citrate and malate in presence of Mn (II) as catalyst. The details of the dark reactions will be the subject of a separate communication to be published in due course.

Chemistry Department,
Lucknow University, T. N. SRIVASTAVA.
Lucknow,
*August* 16, 1946.

1. Mukerji and Dhar, *J. Ind. Chem. Soc.*, 1925, **2**, 277; *J. Phys. Chem.*, 1928, **32**, 1308; *J. Ind. Chem. Soc.*, 1929, **33**, 850. 2. Bhattacharya and Dhar, *Ibid.*, 1929, **6**, 451. 3. Srivastava, *Proc. Ind. Science Congress*, 1944, Part III, Abstracts, p. 26. 4. Qureshi and Veeriah, *Curr. Sci.*, 1946, **15**, 132.

## ALUMINIUM BORATE GEL

IN continuation of our previous work[1] on the preparation of several sols and gels, an attempt has now been made in this laboratory to prepare aluminium borate gel and this communication describes the conditions under which it can be obtained.

When a saturated solution of borax is gradually added to aluminium chloride solution, a bulky precipitate of aluminium borate occurs which dissolves on shaking, but when sufficient quantity of borax has been added, the precipitate settles down in the form of a bulky opaque jelly. By regulating the concentration of borax, transparent jellies can be obtained, and the time of setting can be extended over a period of several hours.

To 2 c.c. of a solution of aluminium chloride, containing 24·88 g. of $Al_2O_3$ per litre, varying amounts of 20 per cent. borax solution were added. The total volume was kept 5·5 c.c. in each case. The mixtures were shaken and the time of setting and the nature of the gel were recorded.

| Amount of 20% borax (c.c.) | Time of setting (hours) | Nature of jelly |
|---|---|---|
| 3·5 | Instantaneous | Opaque |
| 2·8 | 5 | Opalescent |
| 2·7 | 10 | Transparent |
| 2·6 | 18 | Transparent |
| 2·5 | 28 | Transparent |

These jellies are perfectly stable and exhibit no syneresis. On vigorous shaking they assume a liquid form and the viscous liquid so obtained again sets to a jelly on standing, and this process can be repeated several times. These jellies are, therefore, thixotropic in nature.

My grateful thanks are due to Dr. Satya Prakash for his kind interest in this investigation.

Chemical Laboratories,
Allahabad University, S. P. MUSHRAN.
*June* 15, 1946.

1. Mushran, *Curr. Sci.*, 1945, **14**, 123, 200, 233; 1946, **15**, 24. Mushran and Prakash, *J. Ind. Chem. Soc.*, 1946, **23**, 111.

## COMPOSITION OF "RAINTREE" FRUITS

*Pithecolobeum saman* or the Rain Tree is widely grown around Bangalore. The tree bears pods 4-5" long and ½" broad, having 6 to 8 seeds which are enveloped in a sweet edible pulp. The pods are readily eaten by cattle. The pods ripen from March to May and they are specially welcome because cattle food is not available during the dry season in plenty.

Analysis of six samples of the pods of the Rain Tree have been carried out to determine their nutritive value. The average of the results is given in the following table. Figures in column 7 were obtained by subtracting the sum of the rest of the constituents from 100.

*Chemical Compositions (per cent.) of the Kernels, Seeds and Whole Pods*

| | Whole pods | Kernels | Seeds |
|---|---|---|---|
| 1. Moisture | 15·30 | 16·05 | 7·55 |
| 2. Ash | 3·19 | 3·01 | 3·54 |
| 3. Fat | 2·07 | 1·27 | 4·26 |
| 4. Proteins | 12·71 | 10·55 | 28·57 |
| 5. Crude Fibre | 11·43 | 10·77 | 14·05 |
| 6. Sugars | 29·71 | 35·59 | 5·36 |
| 7. Carbohydrates (other than sugars and crude fibre) | 25·59 | 22·86 | 36·67 |
| 8. Calorific value (100 gm. fresh material) | 298·15 | 294·71 | 329·02 |

It was observed that as the season advanced from March to May, the moisture percentage decreased from 20 to 12 per cent. in the whole fruits and the percentage of other constituents increased correspondingly.

The above results closely agree with those for kernels given by Velenzuela and Wester (1930). Padilla and Soliven (1933) found 59·72 per cent. proteins and 11·16 per cent. fat in seeds. These figures are much higher than those given in the above table.

The results show that the pods of Rain Tree are a good source of proteins, carbohydrates and minerals and may equal good quality hay in nutritive value.

The authors wish to express their thanks to Mr. M. C. Rangaswamy, the Director of Dairy Research, for his keen interest and Mr. D. Narayana for supplying the samples of Rain Tree pods.

V. R. Bhalerao.
Noshir N. Dastur.

Imperial Dairy Research Institute, Bangalore,
*August* 31, 1946.

1. Padilla, S. P., and Saliven, F. A., *Philippine Agri.*, 1933, **22**, 408. 2. Valenzuela, A., and Wester, P. J., *Philippine J. of Science*, 1930, **41**, 85.

## THE EFFECT OF PROCESSING AND SOURING MILK BY THE INDIGENOUS METHOD

Various workers have recorded the chemical changes in milk resulting from different types of heat treatment. Anantakrishnan and co-workers[1] have reported as loss the contents of the skin formed on the surface of milk on boiling. But as the practice stands in the Indian household, the skin is invariably utilised for making curd, butter or other food preparations. It is never wasted.

When milk was maintained at the boil (96° C.) for ten minutes and continuously stirred to prevent formation of the skin on top or setting of the casein at the bottom, the loss in milk solids, after correction for the change in volume was found to be almost insignificant —0·28 per cent. total solids, 0·1 per cent. fat and 0·14 per cent. lactose. The per cent. reduction in volume, however, changed widely with the total time taken for heat treatment.

The effect of this type of processing on the bacterial count of milk was also remarkable. When the processed milk was cooled in the open vessel in which it was boiled, the reduction in plate count was from about 130,000 to 275 per c.c. The efficiency was further improved if the heated milk was transferred into a closed vessel and then cooled (360,000 to 120 per c.c.). The greater efficiency was also reflected in the storage property of the processed milk. While the milk cooled in the open vessel and then stored in a closed vessel at room temperature (18°-30° C.) developed 4,000 colonies per c.c. in 5 hours, the milk cooled and stored in a closed vessel had only 2,600 per c.c. after 7·5 hours. It is evident, therefore, that this type of heat treatment is not only more efficient but also better suited than pasteurisation[2] for tropical climate and the actual conditions prevailing in Indian homes.

On souring previously boiled milk with seed curd at 40° C., there was quick rise in bacterial count with the progress in souring. The most significant feature was the uneven distribution of the bacterial population of curd between butter and butter-milk on churning: almost all the organisms passed into butter-milk leaving only a small fraction in butter. A similar observation has also been made in the creamery process of making butter.[3,4] The low-count butter thus produced by the indigenous method compares very favourably with that produced under the best conditions by the creamery process.

The detailed procedure and results of the experiment will be published elsewhere.

I am thankful to Mr. B. N. Banerjee and Prof. V. Subrahmanyan for kind encouragement.

Dept. of Biochemistry,
Indian Institute of Science,
Bangalore, K. S. Rangappa.
*August* 10, 1946.

1. Anantakrishnan, Dastur and Kothavalla, *Indian J. Vet. Sci., and Anim. Husb.*, 1943, **13**, 297. 2. *Rep. Marketing of Milk in India and Burma*, 1943 213, Manager of Publications, Delhi. 3. Grimes, *J. Dairy Sci.*, 1923, **6**, 427. 4. Hammer and Nelson, *Iowa State Coll., Res. Bull.*, 1940, 137, 106.

## ISOMERISATION OF THE DARK GREEN CHROMIUM CHLORIDE, A SEMI-MOLECULAR PROCESS

The process of isomerisation of chromium chloride hexahydrates is shown to be highly complicated by a number of workers.[1,2,3] In the present investigation the authors find that the time taken to complete any definite fraction of the transformation of the dark-green chromium chloride into the hydrated violet form is proportional to the square root of the concentration of chromium chloride. The calculations have been made using the experimental data from the papers of Bjerrum[2] and Lamb and Fonda,[3] who followed the transformation by measuring the changes in the electrical conductivity with time of a freshly prepared solution of the dark-green chromium chloride. The values for $\sqrt{a}/tx$ show complete concordance (where $a$ is the gm. mols. of chromium chloride per litre and $tx$ is the time required for $x$ per cent. change), as will be seen from the results given in the table below:

| $\left(\frac{\sqrt{a}}{t0{\cdot}5 \text{ at } 25°\text{ C}}\right)$ | Concentration of $CrCl_3$ | | |
|---|---|---|---|
| | 0·01074M | 0·00322M | 0·00793M |
| | 0·0032 | 0·0032 | 0·0033 |

For a reaction of the $n$th order $t \propto \frac{1}{a^{n-1}}$.

Now as $t \propto a^{½}$ in the present case, it can be inferred that the reaction is semimolecular. Further from a comparison of the time of the

half change of chromium chloride of the same molar strength at different temperatures, it is seen that the transformation is accelerated to a great extent by a rise in temperature, the rate of the change in equimolar solutions at 25° C. being 2·2 times of that at 19·85° C. and 43 times of that at 0° C. The high temperature coefficient also shows that the order of the reaction is less than unity.

The chlorides of sodium and potassium have no effect on the rate of the transformation. On the other hand, the reaction is considerably retarded by $H^+$ ions. Further work is in progress to elucidate the mechanism of this semi-molecular process.

Department of Chemistry,
D. A. V. College, D. S. Datar.
Sholapur, D. R. Kulkarni.
*August* 3, 1946.

1. Datar and Qureshi., *J. Osm. Univ.*, 1940, **8**, 6-20. 2. Bjerrum, *Z. Physik Chem.*, 1907, **59**, 336; 1910, **73**, 724. 3. Lamb and Fonda, *J. Amer. Chem. Soc.*, 1921, **43**, 1154.

## A METHOD OF CALCULATING "SINGLE-VALUE-FIGURE" FROM THE RESULTS OF AGGREGATE-ANALYSIS OF THE SOIL

The most common and the one very widely used method of presenting the results of aggregate analysis of a soil is by drawing a size-distribution-curve in which the summation percentages of fractions are plotted against the logarithms of their settling velocities in water. In their studies on the effect of different irrigational, manurial and cropping treatments on the periodical changes in the structure of the soil, the authors noticed that the size-distribution-curve failed to bring out prominently the small differences in the structure of the soil brought on as an effect of season and treatment. The mathematical formula suggested by Baver and Rhoades (1932) for characterising the state of aggregation of the soil could not be used, as the aggregate-analysis of the soil was carried out on field-moist sample without dispersion. Similarly the formula suggested by Cole (1938-39) for working out the relative surface area contributed by the soil aggregates graded by sieving could not be correctly applied as the analysis of the soil was carried out by combining the sieving operation with elutriation. In recent years the use of a single-value-figure for specifying a particular property of the soil has gained much favour and it is proposed to give in this note a method of working out a "single-value-index" for studying the structural condition of the soil when the aggregate analysis is carried out by combining the two operations.

### Sieving of the Soil

The sieving of the soil is carried out under the surface of water and the bank consists of sieves having apertures of the following diameters:—No. 1=7 mm., No. 2=4 mm., No. 3= 2 mm., No 4=1 mm., and No. 5=½ mm.

If *a*, *b*, *c*, *d* and *e* are percentage fractions collected on sieves 1 to 5 respectively, then the area contributed by each of the fractions can be obtained by dividing the percentage fraction by the average diameter of the fraction and would be equal to:—

$$a/7\ ;\ b/\frac{7+4}{2};\ c/\frac{4+2}{2};\ d/\frac{2+1}{2} \text{ and } e/\frac{1+0{\cdot}5}{2}$$

the fraction collected on the first sieve being arbitrarily assigned a value of 7 mm. The total area contributed by all the aggregates graded by sieving would be the sum of all the figures shown above and denoted as 'S'.

### Elutriation of the Soil

The elutriator (Kopecky's type) has four cylinders, each separating the particles into aggregates having the ranges of diameters shown below:—

No. 1 = 0·50 mm. to 0·20 mm.; No. 2 = 0·20 mm. to 0·10 mm; No. 3 = 0·10 mm. to 0·05 mm.; No. 4 = 0·05 mm. to 0·02 mm. Particles smaller than 0·02 mm. in diameter pass out of the elutriator, and their percentage is calculated by difference. If $x_1$, $x_2$, $x_3$ and $x_4$ are the percentage fractions collected in cylinders 1 to 4 the area contributed by each of the fractions would be equal to:—

$$x_1/\frac{0{\cdot}5+0{\cdot}2}{2};\ x_2/\frac{0{\cdot}2+0{\cdot}1}{2};\ x_3/\frac{0{\cdot}1+0{\cdot}05}{2} \text{ and}$$

$$x_4/\frac{0{\cdot}05+0{\cdot}02}{2}.$$

The fraction passing cut of the elutriator would contribute an area = $\frac{\text{percentage fraction less than } 0{\cdot}02 \text{ mm.}}{0{\cdot}02}$

The total area contributed by all the fractions graded by the elutriator would be the sum of all the above figures and denoted by letter 'E', and the total area contributed by all the soil aggregates graded by sieving as well as by elutriation would be the sum of the two figures S and E, calculated in the manner described above.

The elutriator separates particles of very fine size and so it will be seen that even small differences in their percentage greatly influence the value for the total surface area of the soil. On the other hand, large differences in the coarser fractions graded by sieving do not affect this value to a great extent. It would, therefore, be evident that soils which contain larger amounts of the finer fractions will show very much higher figures for the total surface area than those which contain smaller amounts of finer fractions. Assuming that high proportions of aggregates less than 0·50 mm. in diameter would affect the structure of the soil adversely, it follows that higher the figure for the total surface area worse the structure.

It is suggested that the single-value-figure calculated in the manner described above would furnish a very useful index for the structural condition of the soil when the grading of the soil is carried cut by combining the sieving operation with elutriation.

Sugarcane Research Station,*
Padegaon, J. K. Basu.
*June* 17, 1946. M. M. Kibe.

1. Baver, L. D., and Rhoades, H F., *Jr. of the Amer. Soc. of Agron.*, 1932, **24**, 920. 2. Cole, R. C., *Hilgardia*, 1938-39, **12**, No. 6, 429-471.

* This Scheme was partly subsidised by the Imperial Council of Agricultural Research, India.

## VIABLE SUGARCANE SEED PRODUCED IN THE UNITED PROVINCES

THE accepted notion so far has been that sugarcane does not set viable seed in the United Provinces. The prevailing low temperature at the time of anthesis is supposed to be responsible for this behaviour.

Due to this belief no serious attempt has so far been made to raise seedlings from fluff occurring naturally in the province. In order to critically test the validity of this belief fluff was obtained this year from Gorakhpur and also from the village Sohna, situated at a distance of forty miles north-west of Basti town. The fluff from Gorakhpur was collected from a field of Co. 313 and the variety from which fluff was obtained from village Sohna, is Co. 356.

The fluff from both these places was planted at Shahjahnpur Research Station in February 1945, at the rate of one gramme to each seedling plot (1'× 1') containing rich soil manured with compost and kept under controlled humidity and average temperature of 60° F. in a glass-house. The fluff from Gorakhpur did not sprout but the fluff from Sohna village sprouted after seven or eight days and the germination was similar to that of the fluff obtained from Coimbatore. This has been repeatedly tested and the successful germination of the local fluff for the first time in these provinces has created great interest as the potentialities of this discovery are immense. Over 1,000 of these seedlings have now been transplanted in the field and their growth behaviour is under critical study.

If it is possible to get fertile seeds from crosses made in U.P. it will open a new line of research which may produce cane varieties better suited to local conditions.

Sugarcane Research Station,
Shahjahanpur, S. B. SINGH.
*July* 30, 1946.

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## A NOTE ON THE OCCURRENCE OF SMUT IN *SACCHARUM MUNJA* GRASS

SMUT is a common disease of cultivated canes caused by the genus *Ustilago*, whereas the genus *Sorosporium* has been recorded (Mundkur, 1942) on *Sorghum* and *S. munja* but the allied genus *Sphacelotheca* has not been recorded before in the country on any *Saccharum*.

In a recent tour to Biknathoree on the submontane tract of Terrai region, a form of *S. munja* was collected from the sides of a stream. A clump of this form when dug out and transplanted and grown at Pusa, produced a large number of arrows, all of which were affected by a smut. The arrows, unlike in the case of the common smut (*U. scitaminea* Syd.) attacking cultivated sugarcanes, did not form a whip. They emerged in the normal manner, but remained short and stunted and appeared blackish (Fig. 1). The florets on examination were found to be all affected, each containing a mass of blackish spores in place of their essential organs (Fig. 2). Further the arrows emerged much earlier than the other forms of the species in the collection at this Station, some of them arrowing as early as May when

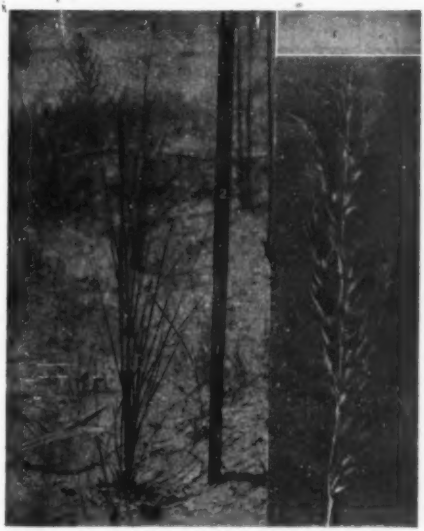


FIG. 1. A small clump about 3 ft. tall with a smutted arrow.

FIG. 2. A portion of the arrow showing smutted florets.

all other forms were not even in short blade. The arrows continued to emerge throughout the season but were all affected by smut. Only a few arrows produced about the same period as normal flowering in other forms (i.e., about middle of November) were normal and healthy.

The specimens of the smutted arrows were sent to Dr. B. B. Mundkur of the Imperial Agricultural Institute, Delhi, who kindly identified the smut as *Sphacelotheca schweinfurthiana* (*Thuemen*) Saccards, a genus of smuts commonly affecting *Sorghum*, but not known so far to be attacking any species of *Saccharum*. The record is, therefore, interesting and opens further possibilities regarding sources of infection for the cultivated crops, particularly because of the very common occurrence of *S. munja* all over this tract.

Besides its occurrence, the attack of smut in this particular case, has produced a rather interesting effect, *viz.*, induced the affected clumps to arrow much earlier than the normal and healthy ones. As pointed out before, the arrows were given out even as early as May when the stalks were young and hardly 3 feet above ground. A similar tendency has already been noticed in the case of common cultivated sugarcanes, affected by *U. scitaminea* where the smutted whips have been shown to be modified floral shoots, produced as a result of early maturity (Rafay and Padmanabhan, 1940). These authors reported cases of arrowing in a smut-affected crop five months old while recent observations in Champaran by the senior author show such arrowing to be

frequent in a 42-days' old crop of Co. 513. The normal time of arrowing for this variety when planted in February is the middle of October.

So far nothing, however, is known regarding the manner this early maturation has brought about, particularly the factors responsible for the change from a vegetative to a reproductive phase, so early in life and long before the normal period of growth has taken place. It would, therefore, be quite interesting to know, whether the fungus, by its presence inside the host, brings about a change in its metabolic processes producing incidentally a phytohormone or some enzymatic secretion which in its turn induces the plant to stop its vegetative growth and proceed to the reproductive phase. If the actual reason of the actual agency behind this phenomenon could be investigated, it will undoubtedly yield a very valuable means for inducing certain late flowering varieties to arrow earlier, or even induce recalcitrant and non-arrowing varieties to arrow with the result that the duration of actual breeding operations may be extended over a large part of the crop season instead the present few months in a year. A certain amount of biochemical work now in progress in these laboratories might throw some light on the subject.

K. L. KHANNA.
K. R. RAMNATHAN.
Central Sugarcane Res. Station,
Pusa, Bihar,
*August* 10, 1946.

1. Mundkur, B. B., *Kew Bull.*, 1942, 209–17. 2. Rafay, S. A., and Padmanabhan, S. Y., *Curr. Sci.*, 1940, **9**, 11.

## THE UREDO-STAGE OF AECIDIUM FOUND ON *THALICTRUM* IN THE SIMLA HILLS

THE occurrence of æcidia on *Thalictrum javanicum* and *T. minus* was first reported in India by Barclay[1] in 1887. Both these species, according to Butler and Bisby,[2] probably belonged to *Æcidium urceolatum*. Arthur and Cummins[3] identified the æcidial material collected by R. R. Stewart on *T. minus* as *Puccinia Rubigo-vera* (DC) Wint. There is, however, no record based on experimental work to connect these æcidia with the uredo-stage of any rust. Mehta[4] has stated that æcidia found in nature on *T. javanicum* near Simla do not belong to the brown rust of wheat because repeated inoculations on the latter always gave negative results.

The writer, for the first time in this country, came across near Simla plants of *Agropyron semicostatum* Nees, leaves of which were infected with a brown rust (*Puccinia persistens* Plowr.), growing close to *T. javanicum* bearing the æcidium recorded before. A brief account of experimental work that established a connection between the two is given in this note.

Æcidia have been observed on leaves and petioles of *T. javanicum* in moist valleys of Simla during the rainy season, *i.e.*, June-August. Inoculations made with the æcidiospores on seedlings of wheat and barley always gave negative results as before but *Agropyron semicostatum* got infected resulting in the production of the uredo-stage of the rust. Æcidia are hypophyllous, in clusters on thickened spots which are purple-brown above and yellow below. They are subcylindrical, yellow, with torn margins. Spores are orange coloured.

In nature infected plants of *Agropyron* are found in the neighbourhood of diseased *Thalictrum*. Inoculations made with uredospores on seedlings of wheat, barley and *Agropyron* infected only the last. A culture of the rust in the uredo-stage has been maintained on its congenial host throughout the year in a greenhouse at Simla. The incubation period is seven to ten days according to weather. Uredosori are minute and orange coloured. Uredospores are more or less globose and measure 22-24 $\mu$ in diameter.

Teleuto-stage is formed when the aerial parts of the grass start drying. Teleutospores have been found to germinate at room temperature (60°-70° F.) without any special treatment and the sporidia to infect young leaves of *T. javanicum*. Spermogonia appeared in seven to ten days and æcidia in seventeen to twenty days from the date of inoculation. An infected leaf is shown in Fig. 1.

FIG. 1 Showing an infected leaf of *Thalictrum javanicum* × 4.

As expected, æcidiospores artificially produced in the greenhouse infected seedlings of *Agropyron* resulting in the formation of uredosori.

This completes the life-history of the rust, the æcidial stage of which had been recorded on *T. javanicum* by previous workers, referred to above.

Mehta[4] has recorded the occurrence of yellow rust on *A. semicostatum* near Simla and the writer has found this grass infected with

black rust. A complete account of the life-history of the latter, resulting in the identification of a new specialised form of *Puccinia graminis* is being published elsewhere. With the identification of brown rust also, as described here, all the three rusts have been recognised on this grass in this country. It should, however, be noted that they are highly specialised on *Agropyron* and do not infect either wheat or barley.

Rust Research Laboratory,
Simla-E., R. PRASADA.
*August* 10, 1946.

1. Barclay, A., *J. Asiat. Soc. Beng.*, 1887, **56**, 350. 2. Butler, E. J., and Bisby, G. R., *The Fungi of India*, 1931, 55. 3. Arthur, J. C., and Cummins, G. B., *Mycologia*, 1933, **25**, 397. 4. Mehta, K. C., *Sci. Mono. No.* 14, *Impl. Counc. Agrl. Res.*, 1940.

## CHROMOSOME NUMBER OF *CASSIA FISTULA*

ACCORDING to the international rules of botanical nomenclature, 1935, it has been proposed that *Cassia fistula* Linn. should be selected as the type species of the genus cassia. This species belongs to the sub-genus *Cathartocarpus* Pers. Tischler (1921-22) has recorded the chromosome number of this species as $n = 12$. As this number happens to be unusual outside the sub-section *Chamæcristæ veræ* Benth., the writer has undertaken to work out the detailed cytology of *Cassia fistula*. As a preliminary to this study a number of temporary aceto-carmine smears of pollen-mother-cells were examined. From the polar views of 1st metaphase 14 bivalents could clearly be counted (Fig. 1) and this number is in variance with

FIG. 1. *Cassia fistula* L. Polar view of first metaphase showing 14 bivalents × 2400.

that previously reported by Tischler. This number $n = 14$ is, however, in conformity with the previously reported chromosome numbers for those species belonging to the genus cassia; which do not fall under the section *Chamæcrista*. Detailed cytological observations are in progress and will be published elsewhere.

Department of Botany,
Andhra Christian College, J. V. PANTULU.
Guntur,
*April* 21, 1926.

1. Tischler, G., *Handbuch der Pflanzenanatomie*, Linsbour, 1921-22, Bd. **2**, *Abt.* 1, Teil 1, 521-683.

## A MODIFIED EMMERT'S FIELD METHOD FOR THE ESTIMATION OF NITRATE-NITROGEN IN PLANTS

EMMERT in his field method for the determination of nitrate-nitrogen in plants lays stress on the tissue being immediately weighed and titurated after detachment to minimise the loss of nitrates. But this method involves cumbersome apparatus and equipment which have to be carried to the field where the resulting colours are compared to rough permanent colour standards for visual estimation. It is with a view towards evolving a more accurate laboratory method which does away with inconvenient and inaccurate field work that the following modifications are suggested.

The main difference lies in the collection of the plant tissue samples in liquid paraffin which prevents the loss of nitrates and at the same time permits very accurate estimation in the laboratory by means of a sensitive colorimeter. By this method the reduction of nitrates to proteins by enzymes which act rapidly in the presence of oxygen is prevented for, liquid paraffin forms an impervious protective film on the cut surface as well as on the stomatal openings. For estimation of nitrates, Emmert's method was followed and the colorimetric comparisons were done according to Reilly and Rae[3] and instructions given by Dastur.[1]

Several experiments were done on different plants to show that by the modified method loss of nitrates is prevented and better results are obtained by the use of colorimeter. These are given in the following tables :—

TABLE I

*Portulaca oleracea* L.

| No. | Time of exposure to air | By Emmert's method of Visual Estimation $NO_3$ in ppm. | Colorimetric Comparison by modified method $NO_3$ in ppm. |
|---|---|---|---|
| 1 | nil | 400 | 346 |
| 2 | 10 minutes | 400 | 312 |
| 3 | 20 minutes | 400 | 191 |
| 4 | 30 minutes | 400 | 166 |

TABLE II

*Amarantus spinosus* L.

| No. | Time of immersion in liq. paraffin in hours | Estimation of $NO_3$ by modified method in ppm. |
|---|---|---|
| 1 | nil. | 186 |
| 2 | 48 | 186 |
| 3 | 74 | 186 |

From the above data it will be observed that :

(1) Nitrates are lost rapidly within a very short time which goes on increasing thereafter and there is a great difference between estimations by Emmert's visual method and the present colorimetric method (Table I). It can also be seen that with mere visual comparison the loss of nitrates on exposure to air is not apparent even when the difference by the present method is sufficiently large.

(2) There is no loss of nitrates even after keeping the tissue in liquid paraffin for 74 hours (Table II).

I must here thank Prof. F. R. Bharucha for suggesting the method and for his valuable guidance.

Botany Department,
Royal Institute of Science, P. J. DUBASH.
Bombay,
*September* 2, 1946.

1. Dastur, R. H., *Indian J. Agri. Sc.*, 1933, **3**, 4. 2. Emmert, E. M., *Plant Physiol.*, 1932, **7**, 2. 3. Reilly, J., and Rae, W. N., Lond. 1922.

## XENIA IN COTYLEDON COLOUR OF GRAM (*CICER ARIETINUM*)

A COMPREHENSIVE investigation on the inheritance of seed-coat and cotyledon colours in gram has recently been undertaken at the Institute of Plant Industry, Indore. Among the gram collections maintained here it is found that there are great variations in the presence and absence of anthocyanin pigment in different parts of the plant, in the size of the pod and seed, in the nature of the seed surface and in the colour of the sead-coat. The usual seed-coat colours met with are yellow, different shades of brown, light red, etc. Among the new acquisitions there are two interesting types, one obtained from a Central India State which has a black seed-coat and another obtained from C.P., which has a green seed-coat. The colour of the cotyledon which can be seen by scraping the seed-coat off is usually yellow in all varieties irrespective of the colour of the seed-coat. The only exception to the above finding is that in the variety with green seed-coat the cotyledon inside is also green.

Among the various crosses that have been made and are under study, the following two are of interest in showing xenia effect with regard to cotyledon colour. The crosses were actually made in 1944-45 *Rabi* season. Under Indore conditions it has been found that the latter half of January is the best period for the setting of pods.

| | Cross I | Cross II |
|---|---|---|
| | Seed Coat Cotyledon | Seed Coat Cotyledon |
| Parents | Green × Green ♀<br>Black × Yellow ♂ | Green × Green ♀<br>Yellowish brown × Yellow ♂ |
| Hybrid seed | Green Yellow | Green Yellow |

It would be seen that while the seed-coat colour of the hybrid seeds in both crosses is the same as that of the maternal parent, the cotyledon which is the result of double fertilization has the colour of the paternal parent, showing dominance of yellow over green.

The hybrid seeds were sown in 1945-46 *Rabi* season and the produce of the $F_1$ plants was collected in March 1946 and examined in the laboratory for seed-coat and cotyledon colours, the latter being distinguished by scraping the coat off at a small spot in each of the seeds. There were obtained one plant with 108 seeds from the first cross and two plants with 279 seeds in the second cross. The results of this examination are given below.

| | Cross I | | | Cross II | | |
|---|---|---|---|---|---|---|
| Seed Coat colour | Light smoky black | | | Yellowish brown | | |
| Cotyledon colour | yellow | Green | Total | yellow | Green | Total |
| Exp. 3 : 1 | 87 | 21 | 108 | 212 | 67 | 279 |
| $X^2$ | 81 | 27 | 108 | 209 | 70 | 279 |
| | | | 0·8 | | | 0·15 |

The above results clearly show the incomplete dominance of black over green and complete dominance of yellowish brown over green with regard to seed-coat colour and the complete dominance of yellow over green with regard to cotyledon colour. That seeds with two kinds of cotyledon colour occur in the same $F_1$ plant confirms the xenia effect observed in the hybrid seed.

While the above results will be confirmed by raising an $F_2$ generation, the full results of all crosses showing the interrelationship among the seed-coat colours and their relationship if any, with other characters like seed size, nature of seed surface, presence and absence of anthocyanin in vegetative and floral parts, etc., will be discussed in a paper to be published elsewhere.

The work was carried out under the guidance of Mr. K. Ramiah, M.B.E., Geneticist and Botanist, Indore.

Institute of Plant Industry,
Indore, B. A. PHADNIS.
*June* 3, 1946.

## *HEMILEIA WRIGHTIAE* RAC. ON *WRIGHTIA TINCTORIA* R. & BR. AND *W. TOMENTOSA* ROEM. & SCH.

IN the months of December 1945 and January 1946, a *Hemileia* was observed on two species of *Wrightia*—*W. tinctoria* and *W. tomentosa*. The rust on the former species was prevalent in the jungles near Walayar (Malabar District) and Samalpatti (near Salem). On the latter host the rust was observed at Kallar (Coimbatore District).

*Hemiliopsis wrightiæ* has been recorded on *Wrightia tinctoria* in Java and was described later as *Hemileia wrightiæ* Rac. (Sydow, 1914; Stevens, 1932). But the prevalence of this rust on these hosts in South India has not been recorded. Thirumalachar to whom our thanks are due, has stated in a private communication (in May 1946) that he has collected *H. wrightiæ* on *W. tinctoria* from Mysore State.

Uredia and telia were observed on *W. tinctoria*. The *æciospores* mentioned by Stevens (1932) were not found. The colour of the sori, which exhibit a mealy appearance on the lower surface of the affected leaves, is at first

orange to cadmium orange, when the urediospores are formed. But with the formation of teliospores there is a change in colour to shell pink.

On *Wrightia tomentosa* the rust has been recorded for the first time. The lower surface of the leaf is thickly covered by extensive powdery light capuchin orange to salmon orange patches of uredia. The urediospores are formed as in other *Hemileia*. One or more hyphæ which may become swollen collect in the substomatal space. These emerge through the stoma and develop a short columnar fascicle outside the epidermis. On the ends of the hyphæ forming the fascicle the spores are borne. Haustoria are clearly seen.

The urediospores are shaped like the segments of an orange, verrucose except on the flattened or concave side and have orange-coloured contents. They measure $23 \times 18\,\mu$ (the range being $15{\cdot}5$ to $28{\cdot}0 \times 12$ to $22{\cdot}0\,\mu$) (Fig. 1). Germination occurs by the formation of a germ tube which is irregularly swollen at the tip with reddish contents.

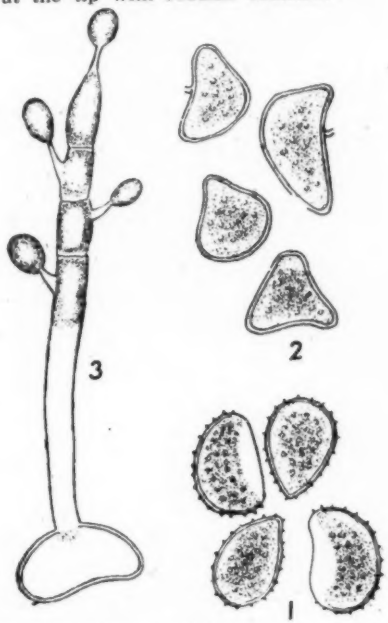



FIG. 1. Uredospores × 400.
FIG. 2. Teliospores × 400.
FIG. 3. Germination of teliospores × 400.

With the development of teliospores the colour of the rust becomes lighter and assumes a white to sea-shell pink tinge. The teliospores are formed on fascicled stalks emerging through the stomatal pore as in the uredia. They are hyaline or light brown, smooth, thin-walled, and of varying shapes. Subglobose and angular spores are present (Fig. 2). Sometimes a remnant of the stalk can be seen projecting from a side of the spore. The apical protuberance was not clear. These measure $25 \times 19{\cdot}0\mu$ (the range being $19{\cdot}0$ to $31 \times 15{\cdot}5$ to $26{\cdot}0$). Germination takes place in fresh spores without passing through a rest period. A stout four-celled promycelium is formed and from each cell a basidiospore develops on a short stalk (Fig. 3). Basidiospores are oval or round, hyaline and often germinate *in situ*.

The rust occurring on *W. tomentosa* resembles the one found on *W. tinctoria*. The measurements of the spores of the rust on the two hosts also agree. Therefore the rust on *W. tomentosa* is identified as *Hemileia wrightiæ* Rac.

T. S. RAMAKRISHNAN.
C. K. SOUMINI.

Department of Mycology,
Agricultural Res. Institute,
Coimbatore,
*May* 20, 1946.

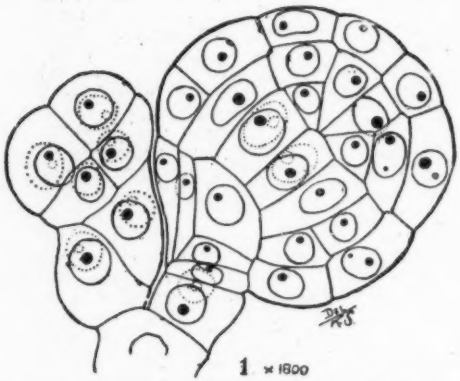
1. Saccardo, P. A., *Sylloge fungorum*, 1902, **16**, 270. 2. Stevens, F. L., *The Philippine Agriculturist*, 1932, **20**, 629. 3. Sydow, P. et H., *Monog. Ured.*, 1914, **3**, 218.

## A CASE OF POLYEMBRYONY IN *ISOTOMA LONGIFLORA* PRESL.

POLYEMBRYONY, so far, has been recorded in only one member of the Lobeliaceæ, and that is *Lobelia syphilitica* Linn. by Crete (1938). In this form, he reports that one, and sometimes two embryos, frequently develop at the expense of the suspensor. The first three or four terminal tiers of cells of the proembryo take part in the formation of the primary body regions of the embryo as has been indicated for other members of Lobeliaceæ and Campanulaceæ. In addition to this normally developing embryo, some of the suspensor cells immediately below the terminal embryo undergo similar divisions and thus form a second embryo. Even in this embryo the body regions can be assigned to certain definite tiers as in the normally developing embryo. Crete further records in the same form that in addition to this new embryo, sometimes another embryo may be formed, in a similar form at the cost of the suspensor.

In the present form, *viz.*, *Isotoma longiflora* Presl., another member of the Lobeliaceæ, we have met with a case of polyembryony which is similar to the one described by Crete for *L. syphilitica*. The mode of embryogeny of this form (to be published elsewhere) closely follows that seen in other members of the Lobeliaceæ and the Campanulaceæ. The terminal three or four cells of the proembryo take part in the development of the embryo. In addition to this embryo, a case was met with in the present form, wherein another embryo appears to have been budded out laterally from a suspensor cell situated below the normally developing embryo (Fig. 1). Even in this lateral embryo three tiers of cells can be made out, each tier consisting of four cells. In all the three tiers the first wall has been

laid in a vertical manner (though slightly oblique in the third tier) and this is soon followed by a second set of vertical walls at right angles to the first, thus resulting in three tiers of cells, with four cells in each tier. The newly budded out embryo is at a comparatively lower stage of development when compared with the normal embryo.



1 × 1800

In *L. syphilitica* Crete reports one or two embryos developing at the cost of the suspensor. In *Isotoma longiflora*, however, the additional embryo appears to have taken origin as a budding from one of the terminally situated suspensor cells.

Our sincere thanks are due to Dr. L. N. Rao for kind encouragement.

Department of Botany, Central College, *July* 30, 1946.

S. B. KAUSIK.
K. SUBRAMANYAM.

1. Crete, Pierre. "La polyembryonie chez le *Lobelia syphilitica* L.," *Bull. Soc. Bot. France*, 1939, **85**, 580–3.

## MOSAIC DISEASE OF RAGI (*ELEUSINE CORACANA* GAERTN.)

THE mosaic disease of ragi has been referred to only by Mc Rae[1] as occurring in the Vizagapatam District of the Madras Presidency as far back as 1928. Since that time no mention has been made of it as far as I can gather, anywhere in India. It will, therefore, be of interest to note that it occurred on a fairly extensive scale in the Mysore State (in the districts of Chitaldrug Tumkur, Kolar and Mandya) during June and July 1946. Due to the failure of the monsoons in 1945, and due to the threat of famine, attempts were made to cultivate an early *kar* irrigated crop of ragi in different parts of the State. The commonest variety found to be attacked was a *gidda* ragi, seeds of which were distributed from Challakere in the Chitaldrug District. A local variety in Malur also got infected by the disease.

The first symptom of the disease is the appearance of pale patches on the green leaves (see figure). These are very distinct as the leaves unroll from the spindle, and hence the newly-opened leaves have to be examined for the characteristic symptoms. The pale areas vary in size and shape, are irregularly oval, and distributed with their linear axes running parallel to the midrib. They are not limited by the veins and are of varying width. Some of the plants in the field may be stunted and show a general yellowing of the leaves. This may be due to abnormal soil conditions or an excessively wet growing period as noticed by Coleman.[2] Mosaic infected plants may recover at a later period of growth and put forth normal earheads. The disease has been noticed to infect from 10 to 30 per cent. of the plants in severe cases.

There is no reason to suspect that the disease is seed-borne, as none of similar diseases has been known to be transmitted in this manner (Brandes and Klaphaak[1]). The disease is similar to sugarcane mosaic which has been known to be transmitted by *Aphis maidis*. It is interesting to note that mosaic infected ragi plants were found to be badly infested with *Aphis maidis*.[3] Jola plants (*Sorghum vulgare* Pers.) in the vicinity showed some symptoms of mosaic, although sugarcane itself was found to be free. It is possible that the sugarcane at that time was not in a stage to show up the symptoms. Kunkel[3] says that goose grass or *Eleusine indica*, and a number of other grasses are subject to mosaic disease in Hawaii and that cross-inoculation tests have not been made although the disease on these plants is probably identical with that on sugarcane. Brandes and Klaphaak,[1] however, obtained negative results in insect transmission experiments with the virus of sugarcane mosaic on *Eleusine coracana* with *Aphis maidis* as vector. They do not take this as conclusive evidence, as admitted by various factors diminished the chances for infection in their experiments at Washington. Smith[5] lists *Eleusine*

*coracana* and *E. indica* among 22 grasses found to be infected with chlorotic leaf markings resembling those of maize streak disease, although he is not definite that they are all due to the same virus. The symptoms of the disease on ragi suggest that it is mosaic rather than a streak disease.

Department of Agriculture
in Mysore, Bangalore, S. V. VENKATARAYAN.
*July* 25, 1946.

* I am indebted to Mr. M. Puttarudriah, Senior Assistant Entomologist, for kindly identifying the aphids.

1. Brandes, E. W., and Klaphaak, P. J., "Cultivated and wild hosts of sugarcane or grass mosaic," *Jour. Agr. Res.*, 1923, **24**, 247–262 (*Rev. Appl. Myc.* **2**, 584). 2. Coleman, L. C., "The Cultivation of Ragi in Mysore," *Dep. Agr. Mys. State. Gen. Ser. Bull.*, 1920, **11**. 3. Kunkel. L. O., "Studies on the mosaic of sugarcane," *Bull. Exper. Stat. Hawaii Sugar. Pl. Assoc. Bot. Ser. iii*, 1924, 115–165. *Rev. Appl. Myc.*, **3**, 608. 4. McRae, W. India, "New diseases reported during 1928," *Intern. Bull. Pl. Prot.*, **3**, 1929, 21–22. (*Rev. Appl. Myc.* **8**, 423–24). 5. Smith, K. M., *A Textbook of Plant Virus Diseases, London*, 1937.

## PERFECT STAGE OF *SCLEROTIUM ROLFSII* SACC. CAUSING PSEUDOSTEM-ROT OF PLANTAIN (*MUSA SAPIENTUM*)

PLANTAIN, *Musa sapientum* Linn. (the variety locally known as *Rasabale*) is subject to a rot caused by *Sclerotium rolfsii*, known as "*taragumari roga*" in Mysore, Bangalore and Tumkur Districts. The fungus was brought into pure culture from the diseased specimens obtained from a garden near Mysore in August 1935. In an attempt to obtain the perfect stage of the fungus in the laboratory the special medium recommended by Mundkur[4] containing onion extract, asparagin and proteose peptone was used. Venkatarayan[5] reported basidiospores in culture on onion-asparagin agar in 40 days. Both test-tube and petri-dish cultures grown at the ordinary laboratory temperature (17°·9–29°·1 C.) and stored for 40 to 60 days, developed a thick hymenium in July 1936. The basidiospores were not noticed on potato-dextrose and oat agars. The hymenium was readily made out by its white colour and dense structure (Fig. 1). The basidia are clavate, hyaline, aerial, short and densely aggregated into crusts. They measure 6 $\mu$ to 12 $\mu$ by 4 $\mu$ to 6 $\mu$, average of 14 measurements being 9 $\mu$ by 4·5 $\mu$. They bear 2-4 sterigmata. The sterigmata are 4 $\mu$ long. The basidiospores (Fig. 2) are smooth, hyaline, ovate and measure 3 to 4 $\mu$ by 2 to 3 $\mu$.

The basidial stage of *Sclerotium rolfsii* has been observed in culture by Goto[2] on strains isolated from various hosts in Japan and by Curzi[1] in Italy on the aster and potato strains. Goto referred the fungus to *Corticium centrifugum* and Curzi named his strain *Corticium rolfsii*. Hirai[3] recorded a sclerotial disease on banana fruits in transport from Formosa due to *Corticium centrifugum*. The basidia of Curzi's strain measure 10 to 15 $\mu$ by 4 to 5 $\mu$ with 2 to 4 sterigmata 4 to 5 $\mu$ long with basidiospores 5 to 7 $\mu$ by 2·5 to 3·75 $\mu$. In India

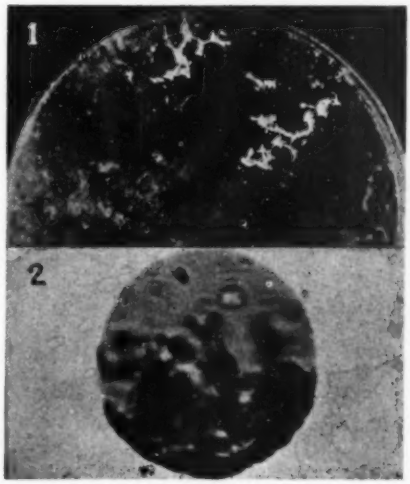



FIG. 1. Petridish culture showing the development of hymenium on onion asparagin agar.

FIG. 2. Microphotograph showing the basidiospores

Mundkur[4] succeeded in getting the perfect stage in cultures isolated from cotton, betelvine, potato and sugarcane. He called the fungus provisionally *Corticium rolfsii* Curzi. The measurements of the basidia, sterigmata and basidiospores, of the plantain strain roughly correspond to those of Curzi, hence the plantain strain is probably *Corticium rolfsii*. The dense nature of the hymenial crust also suggests its being *C. rolfsii* rather than *C. centrifugum*, which has a loose and aerial crust.

The writer is greatly indebted to Mr. M. J. Narasimhan, Director of Agriculture (Retd.), and Mr. S. V. Venkatarayan, Mycologist, for their kind guidance.

Mycological Section,
Agricultural Department,
Bangalore, N. S. VENKATAKRISHNAIYA.
*July* 31, 1946.

1. Curzi, M., *Rev. app. Mycol.*, 1932, **11**, 405, 746, 748. 2. Goto, K., *Ibid.*, 1931, **10**, 344. 3. Hirai, T., *Ibid.*, 1939, **18**, 40. 4. Mundkur, B. B., *Ind. Jour. Agri. Sci.*, 1934, **4**, 779. 5. Venkatarayan, S. V. *Admn. Rept. Agri. Dept. Mysore.*, 1935–193 6, 53.

## TYPE CULTURES FOR THE MICROBIOLOGICAL ASSAY OF AMINO-ACIDS

In persuance of a comprehensive programme[1,2] for determining the suitability of the Type Culture collections for the microbiological assay of vitamins, amino-acids and other active principles, we have found the amino-acid requirements of two of the lactic cultures L.C. 3, N.C.T.C. 2078, and *L. acidophilus*, N.C.T.C. 2087 taken from our repository. Several standard microbiological procedures for the assay of various amino-acids are now available.[3,4,5,6]

The experimental procedure and technique for the preparation of amino-acid mixtures, inocula and the handling of the cultures, are similar to those described by Stokes *et al.*[5] The results are given in Table I. For the purpose of comparison the amino-acid requirements *L. casei* are also given.

TABLE I

*Amino-acid requirements of lactic cultures L.C. 3 and* L. acidophilus

| | Leucine | Isoleucine | Valine | Cystine | Methionine | Trypto-phane | Tyrosine | Phenylala-nine |
|---|---|---|---|---|---|---|---|---|
| *L. casei* N.C.T.C. | + | − | + | + | − | + | + | + |
| L. C 3 N.C.T.C. 2078 | + | − | + | + | − | + | + | + |
| *L. acidophilus* NCTC 2087 | + | − | + | + | − | + | + | + |

| | Asparic acid | Lysine / Serine | Glutamic acid | Histidine | Arginine | Proline | Hydroxy proline | Alanine |
|---|---|---|---|---|---|---|---|---|
| *L. casei* | + | − | + | + | − | + | − | − | − |
| L.C. 3 N.C.T.C. 2078 | + | + | + | + | + | + | − | − | + |
| *L. acidophilus* NCTC 2087 | + | + | + | + | + | + | − | − | − |

| | Threonine | Norleucine | Glycine |
|---|---|---|---|
| *L. casei* | − | − | − |
| L. C. 3 N.C.T.C. 2078 | + | − | − |
| *L. acidophilus* NCTC 2087 | + | − | − |

It will be seen from the table that the two cultures under study require threonine, histidine and lysine in addition to the amino-acids required by *L. casei*; thus covering a wider range of amino-acids. Further work along this line is in progress.

(Miss) M. Prema Bai.
M. R. Raghavendra Rao.
M. Sreenivasaya.

Section of Fermentation Technology,
Indian Institute of Science,
Bangalore,
*September* 9, 1946.

1. Mistry, S. P., and Sreenivasaya, M., *J. Sci. Ind. Res.*, 1945, **4**, 162. 2. D'Souza, V. A. and Sreenivasaya, M., *Ibid.*, 1946, **4**, 647. 3. Dunn, M. S., Shankman, S. *et al.*, *J. Biol. Chem.*, 1943, **151**, 511. —, *Ibid.*, 1944, **155**, 591. —, *Ibid.*, 1945, **161**, 657, 69. 4. Hac, L. R., Snell, E. E., Williams, R. J., *Ibid.*, 1945, **159**, 273, 291. 5. Stokes, J. L., Gunness, M., *et. al.*, *Ibid.*, 1945, **157**, 651. *Ibid.*, 1945, **160**, 35. *Ibid.*, 1946, **163**, 159.

## EPHELIS ON TWO NEW HOSTS*

Two species on grasses, *Isachne elegans* Dalz. (Fig. 1) and *Eragrostis tenuifolia* Hochst. (Fig. 2), were found infected by *Ephelis*, the former at the Paddy Breeding Station, Nagenhally, Mysore, and the latter at the Government Experimental Farm, Hebbal, Bangalore, in 1943-44. The infection was noticed in the vicinity of paddy fields where the crop was also attacked by the same fungus. The infected grasses were stunted in growth. The

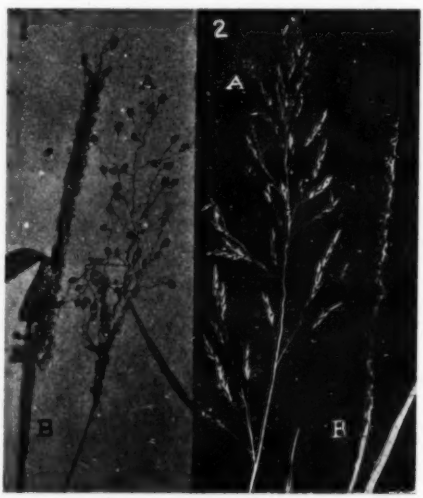



FIG. 1. *Isachne elegans.*

FIG. 2. *Eragrostis tenuifolia*, with healthy (A) and infected (B) inflorescences.

blades showed a lustrous, silvery, greyish appearance. While the inflorescence of *Isachne* and *Eragrostis* is normally a loose panicle 3"-6" long, the diseased inflorescences were

reduced to black spikes 1"-2½". The fungus infects the undeveloped inflorescence, surrounds the florets and the spikelets holding them all together with the main rachis. The mycelial growth forms a sort of sclerotioid mass. It is at first white to dirty grey and later turns black. The mycelium is branched and hyaline. The conidia are produced profusely and detach themselves from the conidiophores and form a gelatinous matrix. The conidia are needle-shaped, hyaline, vacuolate and measure 16 to 28 $\mu$ by 1·3 to 2 $\mu$.

*Ephelis* has been noted on many plants. In India *Ephelis oryzæ* Syd. is a common parasite on paddy in Madras, Mysore, Nagpur and Poona. Butler[1] observed *Ephelis japonica* P. Henn. on inflorescence of *paspalum kora* in Sylhet and apparently the same species on *Eragrostis* sp. in the same locality and on *Panicum sanguinale*, in Dacca. Burkill noticed an ill-developed specimen on *Cymbopogon martini* var. *sofia* in Dharmpur, Punjab. Sydow and Butler[3] recorded *E. pallida* on *Andropogon aciculatus* in Tonkin and Philippines and noted the perfect stage of the fungus on the same specimen from India and called it *Balansia Andropogonis* Syd. Narasimhan and Tirumalachar[2] noted the perfect stage of *E. oryzæ* and proposed a new combination *Balansia oryzæ* for the fungus. The fungus observed on *Isachne elegans* and *Eragrostis tenuifolia* corresponds to that found at the same time on paddy where the spores measure 17 to 28 $\mu$ by 1·7 $\mu$. The fungus is tentatively termed *Ephelis oryzæ* pending further observation of its perfect stage.

The writer is thankful to Dr. S. K. Mukerjee, Curator, Royal Botanic Gardens, Sibpur, and to Mr. S. N. Chandra Sekhara Iyer, Lecturer in Botany, Agricultural College, Coimbatore, for kind identification of specimens and to Mr. S. V. Venkatarayan, Mycologist, Bangalore, for kind guidance.

N. S. VENKATAKRISHNAIYA.

Mycological Section,
Agricultural Department,
Bangalore,
*July* 31, 1946.

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* Paper read before the Agricultural Section of the Indian Science Congress Association, held at Bangalore in January 1946.

1. Butler, E. J., and Bisby, G. R., "The Fungi of India," *Sci. Mono.*, 1931, **1**, 156. 2. Narasimhan, M. J., and Tirumalachar, M. J., *Curr. Sci.*, 1943 **12**, 276. 3. Sydow, H. P., and Butler, E. J., *Fungi Ind. Orientalis*, Pt. III, *Ann. Myco.*, 1911, **9**, 395.

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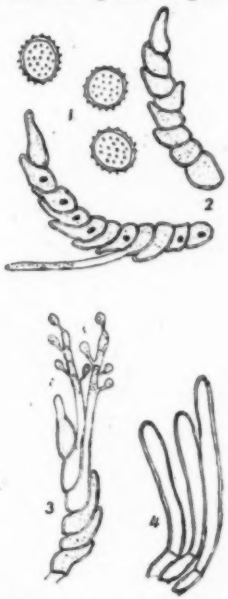
## ON *CATENULOPSORA ZIZYPHI* ON *ZIZYPHUS OENOPLEA* MILL.

IN January 1946, a rust was observed on *Zizyphus œnoplea* Mill. in and around the Fruit Research Station, Kallar, in Coimbatore District. The rust formed a tawny growth on the under-surface of the leaf and was composed of numerous uredia and telia.

The uredia are erumpent. Numerous well-developed, incurved, clavate paraphyses develop round the periphery of the sorus and form a protective covering enveloping the spores in the initial stages. The paraphyses are usually two-celled with a short basal cell and a long terminal cell. They are hyaline or light brown in colour with thickened walls (Fig. 4). The urediospores are stalked, subglobose to oval, reddish-brown, echinulate and measure 22·0 × 19·0 $\mu$ (range being 17·5-28 × 14-24·5 $\mu$). The urediospore germinates readily.

The telia are also hypophyllous, erumpent and sparsely arranged or gregarious. In each sorus an outer ring of 2-3 series of paraphyses is present surrounding the teliospores as in the uredia. The teliospores are one-celled and produced in chains. Each chain is made up of about 8 to 15 teliospores and is 150 to over 300 $\mu$ in length. The chains are free and not laterally united. But the spores forming a chain do not easily separate. A beak-like projection is present on one side of the teliospore and it projects closely pressed to one side of the spore above. All the beaks of the teliospores of a chain are usually on the same side. The topmost teliospore has a centrally placed beak (Fig. 2). The teliospores measure 30·0 × 12·7 $\mu$ (27·9-46·5 × 9·3-13·6 $\mu$). In measuring the length of the teliospore the beak is also included. The teliospore wall is smooth and the spores are coloured light brown. Germination of the teliospore takes place in 8-12 hours. No resting period is necessary. The upper spores of




FIGS. 1. Urediospors. 2. Teliospores. 3. Germination of teliospes. 4. Parapyhses. All × 200.

the chain germinate more readily than the lower ones. The beak elongates, and develops into a hyaline basidium. The upper end of the basidium is four-celled and from each cell a sterigma is developed. An oval or round hyaline basidiospore is formed on each sterigma (Fig. 3).

Pycnial and æcial stages were not present. The morphological features of this fungus suggest that it belongs to the genus *Catenulopsora* erected by Mundkur and Thirumalachar (1943). This genus has been recorded by them on *Flacourtia sepiara* Roxb. and *Ampelocissus latifolia* (Roxb.) Planch.

Two rusts have been recorded on *Zizyphus* from India (Butler & Bisby, 1931). These are *Crossopsora zizyphi* (Syd. & Butl.) Syd., and *Phakopsora zizyphi-vulgaris* (*P. Henn.*) Diet. The fungus now described does not come under either of these genera. In *Crossopsora* a columnar telium is present. The telia in *Phakopsora* from a black lens-shaped crust and dark-brown spots are developed on the upper surface of the leaf. The rust under consideration does not form dark-brown spots on the upper surface of the leaf. A columnar telium is absent nor is it black in colour. The occurrence of the teliospores in free chains and the absence of germ pores bring this fungus into the genus *Catenulopsora*. This kind of rust has not been recorded on this host. Hence it is proposed to name this fungus, *Catenulopsora zizyphi*.

*Catenulopsora zizyphi* sp. nov. Uredia hypophyllous, erumpent, surrounded by a ring of clavate incurved paraphyses; urediospores subglobose or oval, reddish-brown, echinulate $22{\cdot}0 \times 19{\cdot}0\,\mu$. Telia hypophyllous, erumpent, surrounded by a ring of paraphyses; teliospores catenulate, not laterally united, provided with a beak on one side and adpressed to the spore above, one-celled, smooth-walled, light brown in colour $30{\cdot}0 \times 12{\cdot}7\,\mu$, germinating without a rest period, basidium given off from the tip of the beak; basidiospores 4, hyaline, oval or round.

Habitat, in living leaves of *Zizyphus œnoplea* in the neighbourhood of the Fruit Research Station, Kallar, Coimbatore District, Madras. Collected by T. S. Ramakrishnan and C. L. Subramaniam in January, 1946. Type specimens deposited in the Herbarium of the Government Mycologist, Lawley Road P.O., Coimbatore.

*Catenulopsora zizyphi* Ramakrishnan and Subramaniam, spec. nov.

Uredia hypophylla, erumpentia, circumdata anulo paraphysum, clavatorum, incurvorum. Urediosporæ subglobosæ vel ovales, rubricosæbrunneæ, echinulatæ $22{\cdot}4 \times 18{\cdot}9\,\mu$ (potest esse $17{\cdot}5\text{-}28 \times 14{\cdot}0\text{-}24{\cdot}5\,\mu$). Telia hypophylla, erumpentia, circumdata externo anulo paraphysum, duo vel tres serium. Sporidia catenulata non lateraliter unita, rostrata, unolateri et adpressa sporidio superno, unicellata, leviba, pallida brunnuea colore, $30{\cdot}0 \times 12{\cdot}7\,\mu$ (potest esse $27{\cdot}9\text{-}46{\cdot}5 \times 9{\cdot}3\text{-}18{\cdot}6\,\mu$). Germinat sine quiete, Basidium proferens e vertice rostri. Basidiosporæ quattuor, hyalinæ, ovales vel rotundæ.

*Habitat*. In foliis vivis *Zizyphi œnoplæ* in vicinitata "Fruit Research Station", Kallar, Coimbatore District, Madras. Collecta per Ramakrishnan et Subramaniam in mense Januario 1946. Typi specimina deposita in "Government Mycologist's Herbario", Coimbatore.

Our thanks are due to Rev. Father M. Singarayar of St. Joseph's Seminary, Coimbatore, for the Latin translation.

T. S. RAMAKRISHNAN.
C. L. SUBRAMANIAM.

Department of Mycology,
Agricultural Research Institute,
Coimbatore,
*April* 25, 1946.

1. Butler, E. J., and Bisby, G. R., *Fungi of India*, 58 and 62. 2. Mundkur, B. B., and Thirumalachar, M. J., *Ann. Bot.*, London, 1943, **7**, 213–20.

## RESEARCH SCHEMES SANCTIONED

THE Governing Body of the Council of Scientific and Industrial Research, at its recent meeting, sanctioned several new schemes of research on the recommendation of the Advisory Board costing about Rs. 2,60,000. The schemes include atomic research at the Tata Institute of Fundamental Research, Bombay, and the Bose Research Institute, research on Nuclear Physics by Prof. M. N. Saha and preparation of tannic acid from myrobalans.

The Governing Body approved the final plans for the establishment of the Fuel Research Institute and the National Metallurgical Laboratory in India. The Fuel Research Institute is to be located near Dhanbad at an estimated capital cost of Rs. 14 lakhs and the National Metallurgical Laboratory will be located at Jamshedpur with an initial capital expenditure of Rs. 42·8 lakhs. Architects for these laboratories have already been appointed by the Council and detailed estimates, plans and designs will be submitted by them for the approval of the Council.

The Governing Body noted with satisfaction that the Government of Bombay had agreed to the location of the National Chemical Laboratory on the Pashan Road at Poona and that the required land would be transferred to the Council for this purpose.

# REVIEWS

**Physical Methods of Organic Chemistry, Vol. II.** Edited by A. Weissberger. (Interscience Publishers Inc., New York), 1946. Pp. 737-1367. Price $8.50.

The volume under review is the second one of the same title* and deals with the following ten topics: Spectroscopy and Spectrophotometry; Colorimetry, Photometric Analysis, Fluorimetry; Polarimetry; Determination of Dipole Moments; Conductometry; Potentiometry; Polarography; Determination of Magnetic Susceptibility; Determination of Radioactivity; Mass Spectrometry. It is inevitable in a composite volume by different authors that all the monographs do not show a degree of uniformity of treatment that one expects in a book by one author even though such co-ordination is the task of an editor. The preface to the volumes prepares one to expect such uneven treatment of the topics.

A perusal of the monograph on spectroscopy leaves one with a feeling of incompleteness and references to other sources a necessity. An organic chemist often has to use infra-red absorption for quantitative measurements which requires an accurate measurement of cell thickness and this appears to have no place in the monograph. In dealing with the choice of prism material, no mention of the disadvantage of quartz for quantitative work in the 2·9 $\mu$ region is made. The usefulness of the chapter on colorimetry will be increased by the addition of sections on nephelometry.

One of the best monographs in the volume is the one on Polarimetry by Dr. Heller. A thorough discussion of the experimental technique in the different spectral regions more than compensates for the meagre theory in the beginning. The importance of visual polarimetry is well brought out and it is interesting to learn that "The sensitivity of the adapted eye is not surpassed by any artificial recording device".

Prof. Smyth's article is the shortest in the volume, dealing exclusively with the experimental determination of dipole moments and the details given are enough for any one to build the necessary apparatus.

The chapters on Conductometry and Potentiometry give useful and clear accounts of the topics though a fuller treatment of non-aqueous solvents is desirable. Muller's account of Polarography is an adequate introduction to an organic chemist contemplating the use of the polarograph besides indicating systems where there is paucity of studies. The chapter on Magnetic Susceptibility is not up to the standards of the rest of the volume.

The chapter on Radio-activity, no doubt, gives a useful account of the methods of measurement but the organic chemist is equally interested in methods of introduction of radio-elements into his systems. It is hoped that later editions will give adequate attention to this aspect as well.

One of the late comers in the field of tools for the organic chemist is the Mass Spectrograph, not the least important cause being the enormous cost of the instrument which places it beyond the reach of most organic laboratories. The successful use in tracer work in American laboratories bring this technique into prominence.

There are a few misprints in this well got-up publication, *e.g.*, "*a cross-section* of 0·5 to 1 c.c." on p. 1223, which has escaped correction. There is no author index and the subject index at the end of this volume covers both the volumes. The index will be more useful if each volume has its own or the common index appears in both volumes as in Taylor's *Physical Chemistry*.

The volume will be found useful by advanced students of the Physical Sciences though the price (not mentioned in the volume) judging from a bookseller's list, will be beyond the reach of the average student of this country.

S. V. ANANTAKRISHNAN.

**An Introduction to the Chemistry of Cellulose.** By J. T. Marsh and F. C. Wood. Third Edition. (Chapman and Hall, Ltd., London), 1945. Pp. xi + 525 + xiii plates. 32*sh*.

The appearance of the third edition of this very useful book within a short interval of the second edition demonstrates the need of such books dealing with accurate information on a progressive scientific subject. The authors have done an admirable job in bringing this book up-to-date with regard to several aspects of cellulose chemistry and its industrial application. The insertion of sections dealing with the chemistry of wood pulp and paper and many other additions has increased the size of the book by 42 pages as compared with the second edition. With an exception of minor changes and omitions, most of the matter from the previous edition has been incorporated in the present edition.

Perhaps, the book would have been all the more useful from the point of view of the student and the research worker, if the subject-matter instead of being presented as a collection of reference (at least that is the impression one gets after reading several of the later chapters) had been more critical and explanatory. To those with certain amount of experience and study of the subject, the book can serve as a valuable source of scientific information on the subject.

The general arrangement of the chapters is satisfactory in that it provides a good general background for the detailed considerations of the various developments that have taken place during the recent years.

A few misprints and inaccuracies occur in the text. For example, Venkatraman is spelt as 'Venkatrama' and on page 298, description

* Vol. I was reviewed in this Journal, **15**, p. 86.

of the back titration method for estimating carboxylic acid groups in cellulose gives the impression that the method was originally developed by Nabar, Scholefield and Turner and not by Neale.

The book should find a useful place in the library of every scientific institution and cotton mill.

G. M. NABAR.

**The Cathode-Ray Oscillograph in Industry.** By W. Wilson, D.Sc. Second Edition Revised. (Messrs. Chapman & Hall, London, W.C. 2), 1946. Pp. xii + 244. Price 18*sh.* net.

This is the second edition of Dr. Wilson's well-known book. It is divided into 12 chapters and is copiously illustrated with beautiful photographs, diagrams and graphs. The first three chapters deal with general principles and a description of the oscillograph and its auxiliary circuits. The next chapter deals with the modern types of oscillograph. This is followed by six chapters dealing with the applications of the oscillograph. The illustrations are drawn from a very wide field and are quite representative. The last two chapters deal with the electron microscope and the operation and maintenance of oscillographs respectively. The inclusion of the description of the electron microscope is most welcome and useful. The principles are essentially the same. Since both the oscillograph and the electron microscope are widely employed in industry, everyone needs a book on both and the inclusion of a description of both increases the utility of the book. But this makes the title of the book a little unhappy. In the opinion of the reviewer, it would be more appropriate to call the book, "The Cathode-Ray Tube in Industry". In the appendix are given a description of thermionic valves, photo-cells, oscillators and piezo-electric crystals. The description is very sketchy. The main portions of the book cannot be understood properly by a person who is not familiar with the basic principles of electronics and, if the same were attempted in the appendix, it would have become very large. Therefore, it would be very desirable to drop this part of the appendix in the later editions. Similarly, the description of high vacuum pumps in the main body of the book may be deleted in a later edition.

This second edition has more matter than the first and parts have been revised. Descriptions of the miniscope, the electrionic switch, the cathode-ray fault finder, steel sorting apparatus, strain gauge, etc., are new. More details have been added to the description of echo detection, etc. The chapter on the electron microscope has been made up-to-date.

On the whole, it is a very well written book giving a very authentic and accurate account of the applications of the oscillograph to civil, electrical, radio, metallurgical and mechanical engineering and to physics. The book should find a place in the libraries of science and engineering colleges. Quick and ready methods of testing materials using the oscillograph are now being developed and standardised and, in view of this, the book will be found most useful to all interested in routine testing.

S. V. CHANDRASHEKHAR AIYA.

**Electric Discharge Lamps.** By H. Cotton. (Messrs. Chapman & Hall), 1946. Pp. 435 + xvi. Price 36*sh.* net.

There are twelve chapters in this book. The first nine chapters deal with different branches of physics, a knowledge of which is necessary for the understanding of the design, construction and the operational principles connected with the various types, of discharge lamps. The last chapter is a summary of the known facts relating to colour, its measurement and standardisation. The presentation in all these chapters is mostly simple and does not involve any difficult physics or mathematics.

Only two chapters may be said to deal with the subject proper. Nevertheless the various forms of discharge lamps that are being used in actual practice are very fully described and their operational details clearly presented. Useful technical data are furnished. The principal ones in use are the sodium, neon and mercury discharge lamps and their relative merits have been discussed. The book is a valuable contribution and is likely to be of great help to the Illumination Engineer as well as the physicist.

S. B.

**The Indian Ecologist.** Edited by Dr. F. R. Bharucha. (Indian Ecological Society, Royal Institute of Science, Bombay 1). Rs. 8 per volume for members.

No one will pretend that the science of Ecology has been accorded its rightful place in our country. Little is it realized that a thorough Ecological survey is of immense assistance in the task of implementing our gigantic plans for the rehabilitation of Agriculture and Sylviculture. And yet Ecology is a comparatively new enterprise with us. The Journal under review is a maiden attempt to mobilise interest in this important branch of knowledge and, therefore, provides a much-needed forum for the co-ordination of the different facets of Ecological Science.

The first number embodies discourses on a wide variety of topics and this is a happy augury for the future. In the opening paper extensive data are provided to show the differences in the micro-climate of our important crops. This is an aspect which has received little attention among Indian Ecologists and the present contribution indicates the possibilities for future investigators. One would wish, however, that there was a wider reference to plant communities in the Indian forests. Then there is a stimulating paper on "Contour Strip Cropping" as a devise for soil conservation. Studies on the adult Trichoptera reveal how ecological studies may serve as indices of evolutionary trends.

It will be admitted that the cost of the publication borders on the prohibitive but we are assured that this is a temporary phase consequent on the present abnormal conditions. The get-up is excellent and attractive and the Journal needs warm support and encouragement.

K. V. S.

**D.D.T.—The Synthetic Insecticide.** By T. F. West and G. A. Campbell. (Chapman and Hall, Ltd.), 1946. Pp. 301. Price 21*sh.* net.

This publication is an exhaustive review of the World literature on D.D.T., now very extensive and widely scattered. The extremely varied and complicated researches on a bewildering variety of aspects of use of this synthetic insecticide for medical, health, veterinary, agricultural and horticultural purposes, reviewed in this book, present the results derived up to the autumn of 1945 and should therefore be considered to be very up-to-date.

Few developments during the last decade have stirred the imagination of mankind more than the spectacular achievements made possible by the liberal use of D.D.T. for Military needs both at the home and Field fronts.

Rt.-Hon. Winston Churchill in his broadcast of September 28, 1944, said: "We have discovered many preventives against tropical diseases, and often against the onslaught of insects of all kinds, from lice to mosquitoes and back again. The excellent D.D.T. powder which has been fully experimented with and found to yield astonishing results will henceforth, be used on a great scale by the British Forces in Burma and by the American and Australian Forces in the Pacific and India in all theatres." Recently the possibilities of post-war developments in its use for peacetime problems have also fully been investigated and been found to be enormous.

When D.D.T. was first made in 1874 or when it was again reviewed in 1939 by J. R. Geigy, S. A. of Basle—Switzerland, who found that it killed bugs and checked a plague of potato beetles, little did he or any of his collaborators dream that the material bid fair to assume a revolutionary importance in all fields of human activity in a remarkably short space of time.

The fourteen chapters—apart from the Prologue and the Epilogue, of which this book on D.D.T. consists, deal in great detail with such extremely important and instructive topics as: The Original Basle Researches; Manufacture and Chemistry; Principles of Formulation; Toxic Manifestations; D.D.T. in Paints and Miscellaneous Materials; D.D.T. against Human Lice; D.D.T. against Mosquitoes; D.D.T. against Household Pests; D.D.T. against other Pests affecting Men and Animals; D.D.T. against Plant Pests; and Miscellaneous Uses of D.D.T.

The authors point out rightly that "even in these days of intensive research, it is an unusual experience to witness within the short period of one decade, an original discovery pass through all its laboratory stages of test and trial, to develop into a major factor of change. This is the story of dichloro-diphenyl-trichloroethane—D.D.T."

The intensive and extensive investigation on the several different physical forms in which D.D.T. can be used to meet all manner of conditions; its particularly potent characteristic of persistence over long periods and the wide possibilities of incorporating it in certain manufactured materials where temperatures do not rise too high in the process, as also the finding of the effective concentrations at which D.D.T. should be applied to derive maximum benefit, together form a chain of work of an army of researchers, which the authors have very ably and lucidly presented to the scientific worker and the intelligent reading public. Special efforts have been put forth by the authors in collecting and analysing the experiments carried out over a wide range, in the matter of proving, that, at working concentrations, D.D.T. is reasonably "safe" to man, while being absolutely "killing" to the insect enemy. In this connection the authors state that "The position to-day is, however, still to be recognised as experimental. While the Military authorities have been so well satisfied with the applications of D.D.T., already worked out and applied under so many varying conditions, it must be assumed that there are new conditions affecting civilian applications; much will be learnt, therefore, from the wider and large-scale practice of the present and future years".

The possibilities of the use of D.D.T. in paints, textiles and paper, have opened up an entirely new field of operation, the scope of development in this direction being almost unlimited. Perhaps, the most potent check to the activities of disease-carrying insects like the fly, has been, this wonder synthetic insecticide —D.D.T.

Pressing military needs, encouraged by very successful results of varied experiments carried out by a host of scientists, enlisted this insecticide for large-scale use in operational theatres, in refugee camps and a number of other front-line situations; the repercussions have been to say the least, amazingly satisfactory. One would, however, wish that the same could be said of D.D.T. where its use in combating the army of serious insect pests of food and other crops is concerned. This field of work is comparatively new and notwithstanding the vast amount of tests already made in different countries, with D.D.T., the stage has not been reached when it could be looked upon as the 'saviour' of man against 'crop-pests'. Most of the researches carried out in this direction have been of the 'laboratory' size only. Priorities for large-scale field tests against crop-pests, have rarely been available during the pendency of the war; war being now finally over, the present and the future will certainly offer the necessary facilities for harnessing D.D.T. to larger and assured uses in our constant fight against hundreds of varieties of destructive insects. But one factor that looms large and keeps scientists worried in this matter is, undoubtedly, the presence, in nature, of hosts of "beneficial insects" dispersed among "destructive insects" in an almost perfect balance; where D.D.T. is concerned, both groups of the insects are alike susceptible and if the very finely balanced state of existence in nature of these two groups is to be upset, if not destroyed, the outcome appears difficult to evaluate at this stage; the least that could be said about it is that such a thing would be hardly desirable. What makes D.D.T. a "dreaded stuff" is its "residual action"; while this property is extremely welcome in the case of combating the destructive insect pests, in the matter of preservation of the beneficial insects,

it might prove positively dangerous—a contingency that all believers in well established natural phenomena would always like to avoid. With reference to this matter the authors pertinently state that while D.D.T. offers great hope in the tremendous field of plant-pests, for more efficient methods of controlling some of them, there goes with this possibility the challenge of its effect on beneficial insects. With an insecticide of such scope and power, as D.D.T., it is to be expected that extreme care will be necessary in meeting the dangerous by-effects which are inevitable with most worth-while discoveries. The overcoming of this problem may lead to work on the possibility of spraying at carefully selected times or under special conditions, which, quite apart from D.D.T., may stimulate fruitful lines of research. A tremendous field awaits the formulator of emulsions—whether the emulsions should break quickly; whether the D.D.T. should be dissolved in a solvent (before emulsification) which would be likely to evaporate or otherwise deposit D.D.T. It is now generally recognised that the exact physical form in which the insecticide is made available to the insect, is of paramount importance."

The authors attach a most interesting Epilogue to their book, in which, characteristically enough, they close their worthy efforts at reviewing the varied and extensive researches on D.D.T. by declaring their belief in D.D.T. enabling, in future years, millions of backward peoples in remote parts of the world to live longer and in a better state of health.

The publishers deserve great credit for having spared no efforts in making the book extremely handy and attractive.

**Report of the Scientific Advisory Board** for the year 1st January to 31st December 1945. Issued under the authority of the Governing Body, Indian Research Fund Association, New Delhi. (The Secretary, Governing Body, Indian Research Fund Association, Secretariat, New Delhi.) Pp. 164. Re. 1.

The Annual Report of the Scientific Advisory Board for 1945 sets out in a succinct manner the various and varied activities of the Indian Research Fund Association in the sphere of medical research. Reports of the Advisory Committees on Cholera, Malaria, Nutrition, Plague, Clinical Research, Maternity and Child Welfare, Rabies and Industrial Health are also incorporated. Results of work on the treatment of cholera with sulphaguanidine and the statistical evaluation of the data on anticholera inoculation are included as also a note on the preparation of a new cholera vaccine and a method of testing the potency of cholera vaccines. Investigations with various insecticides and mosquito repellants, and studies on mammalian malaria are reported.

Nutrition continues to be a major subject of research of the Indian Research Fund Association and the schemes financed during the year embrace a wide field covering both the theoretical and practical aspects of nutrition. The vexed question of the comparative nutritive value of animal *vs.* vegetable fat, and animal or vegetable fat *vs. vanaspati*, the methods of treating sick starving destitutes, evaluation of proteins in terms of hæmopoietic activity, etc., have been investigated during the year. A fairly detailed account of the progress of nutrition work in the Provinces and States is included. Clinical Research takes up a good slice of the Report and the proceedings of the first meeting of the Clinical Research Advisory Committee constitute interesting reading. The budget allotments for the 48 enquiries, financed by the Association, and for the publication of the *Indian Journal of Medical Research*, appear towards the end of the Report. Those interested in the progress of medical research in India will find the Report extremely useful and informative.

S. RANGANATHAN.

**Studies on Protein, Fat and Mineral Metabolism in Indians.** By K. P. Basu. Special Report, I.R.F.A., No. 15. (The Job Press, Cawnpore), June 1946. Pp. 64. Price As. 12.

This is a review of the activities of a group working as a unit in the Biochemical Laboratory of the Dacca University under the auspices of the Indian Research Fund Association and embodies the results achieved during a space of eight years on a rather difficult and tedious problem of metabolic studies on human experimental subjects. The investigations include a study of the intake and excretion of proteins, fats and different minerals by apparently normal adults. The minimum daily requirements of the various dietary constituents have been determined and the adequacy of typical Indian dietaries with regard to these factors have been investigated by actual metabolic experiments. The effect of cheap and easily available supplements in making good some of the deficiencies, particularly that of calcium, has been studied. The mutual influence of minerals in metabolism and the role of vitamins in the metabolism of the various minerals have also been investigated. Stress is rightly laid on the need for knowledge of the metabolic processes in the normal individual before deviations from the normal as also pathological changes can be appreciated and evaluated.

While most fats and oils, animal and vegetable, have a high digestibility coefficient, *vanaspati* has a comparatively lower absorption coefficient. This is explained as due to the raising of the m.p. of the fatty acids during hydrogenation. The author pleads for fixing an upper limit (preferably below 40°) for the m.p. of hydrogenated fats and oils which the manufacturers should not be permitted to exceed. Looking at Table XIII on p. 20 with a daily negative balance of 113·9 mg. of Ca and a corresponding positive balance of 305·1 mg. of P on a coconut oil diet, one is tempted to wonder at the fate of the millions of inhabitants of the West Coast of the Madras Presidency to whom coconut oil is perhaps the only source of fat; they are apparently none the worse for it.

The results of metabolism experiments get somewhat complicated with negative balances observed on numerous occasions. Percentage retention calculated on the basis of a so-

called improvement, from a bigger negative balance, does not appear to be quite happy. A useful bibliography is included. The Report contains ample evidence of hard and painstaking work put in the elucidation of a rather intricate problem in human metabolism.

S. RANGANATHAN.

**Food Control and Nutrition Surveys (Malabar and S. Kanara).** By K. G. Sivaswamy and others. (Servindia Kerala Relief Centre, Royapettah, Madras), May 1946. Pp. 225. Rs. 4-0-0.

The Servindia Kerala Relief Centre have recently put out a number of publications on the appalling conditions of the people of the West Coast of the Madras Presidency brought about by the present food distress. The book under review is one such and deals with the conditions of food control and nutrition surveys in Malabar and S. Kanara. The effects of food scarcity on public health have been assessed by a band of eleven doctors and the results set out as also the working of measures of food and price controls. The surveys begin with two statements issued by the Hon'ble Dr. Pandit H. N. Kunzru, President of the Servants of India Society, and Member of the Central Food Advisory Committee. This is followed by two articles by the late Mr. V. R. Nayanar on famine, cholera and orphanages. Mr. L. N. Rao has contributed an article on the food of the Malabar aboriginals based on his own enquiries and those of the teachers at Chelode. This is followed by a critical analysis by Mr. K. G. Sivaswamy of the food distress and the various control measures introduced by the Government of Madras during the last four years. A number of useful appendices is included which give data regarding family dietaries, medical and nutritional surveys, vital statistics, etc.

A section of the book deals with food and price control in S. Kanara by Dr. Kakade, the chronology of food events and a nutrition survey by Dr. Bhat. The chronology of food events constitutes interesting reading and shows how the prices of agricultural products soared to dizzy heights in January 1943.

The book contains much useful information, painstakingly collected but unfortunately not happily marshalled. Mistakes are comparatively rare, a glaring one being on the first page 67, "12 ounces of rice supplied only about 100 calories". While on this point, the reviewer cannot help giving vent to his feelings of revolt at the pagination of the book. A mere perusal of the contents of the book will at once show that pages 1 to 65 occur thrice. Reference to pages becomes obviously difficult and complicated. This is not the first instance that the publishers revel in such confusion in pagination. An anomalous "Introductory" appears in the middle of the book, after the second 84th page, the pages of which are numbered in Roman letters.

S. RANGANATHAN.

**Inadequate Diets, Deaths and Diseases and a Food Plan for Madras.** By K. G. Sivaswamy and others. (Servants of India Society, Royapettah, Madras), May 1946. Pp. 72+11. Rs. 2.

The author examines the number of excess deaths in the province of Madras during the period of food scarcity, 1943-44 and the causes of such deaths. Most of the deaths were due to cholera, small-pox, malaria and such nutritional diseases as dysentery, diarrœha, etc. A study of 4,500 patients in the coastal areas between Cape Comorin and Mangalore during the early part of 1945 showed a preponderance of anæmia, scabies, digestive troubles and nervous diseases. The diets consumed in the different areas and their deficiencies have been critically studied. An instructive note on nutritional diseases and certain food hints based on traditional knowledge are also included. Informative notes on the diets of natives in the islands of the Indian Ocean, of S. Africa and S. America, and of the inhabitants of occupied Europe are appended. The relation of an excessive carbohydrate food to œdema, anæmia, ulcers and nervous diseases is discussed. A food plan for Madras which aims at correcting the prevalent diet deficiencies is recommended by the author. Due note has been taken to supply protective foods to the more vulnerable groups of the population. The author has examined certain short-range programmes for increasing food production and has put forth small schemes for conservation of rain water, expansion of the fishing industry and improved methods of goat-breeding by artificial insemination. The book contains much useful information and extremely practical suggestions calculated to tide over the present food crisis.

S. RANGANATHAN.

## SCIENCE NOTES AND NEWS

*Adam Hilger, Limited.*—On June 30th, 1946, Mr. Frank Twyman, F.Inst.P., F.R.S., resigned his position as Managing Director of Adam Hilger, Ltd., which he has held since 1902, to become Technical Adviser to the firm and to their associates, E. R. Watts & Son, Ltd., the well-known makers of Surveying Instruments. Mr. Twyman remains Chairman of Hilger's.

His place as Managing Director is taken by Mr. G. A. Whipple, M.A., M.I.E.E., F.Inst.P. Mr. Whipple, who is also Managing Director of Watts, is the son of Robert S. Whipple, Chairman of the Cambridge Instrument Company.

Mr. Twyman came to Hilger's in 1898; he became Manager of the firm on the death of Mr. Otto Hilger in 1902 and Managing Director of the Company on its incorporation in 1904. Under Mr. Twyman's direction the firm has

specialised in the manufacture of optical instruments for research in physics and chemistry and for the control of industrial processes.

The instruments put on the market by the firm during that time have contributed not a little to knowledge in atomic and molecular physics and have brought optical glass work to a higher level of perfection, not only in this country, but in the world generally.

In recognition of the value of these instruments, many of them designed by Mr. Twyman himself, he was in 1924 elected a Fellow of the Royal Society.

Mr. G. A. Whipple, after graduating at Cambridge, carried out research work in Germany and in this country. He has served on the Council of the Institution of Electrical Engineers and has been Hon. Secretary of the Scientific Instrument Manufacturers' Association for the last six years. He is a member of the Boards of Governors of Northampton Polytechnic and the National College of Horology.

It is intended that Hilger's should continue to pursue the same policy as heretofore, but on a larger scale, made possible by combining the productive and technical resources of the two firms.

*Andhra University: Award of Research Degrees.*—On the recommendation of the Board of Examiners consisting of (1) Prof. M. Born, M.A., Ph.D., F.R.S., Department of Mathematical Physics, the University of Edinburgh, (2) Dr. E. C. Bullard, Department of Geophysics, the University, Cambridge, and (3) W. A. Wooster, Esq., Department of Crystallography, the University, Cambridge, appointed to adjudicate on the thesis "Studies in Ultrasonic application to Elastic Constants of Substances", resolved that Mr. J. Bhimasenachar, M.Sc., be declared qualified for the Degree of Doctor of Science (D.Sc.).

On the recommendation of the Board of Examiners, consisting of (1) Prof. Sir Ian Heilbron, D.S.O., LL.D., F.R.S., Imperial College of Science and Technology, London, (2) Prof. A. R. Todd, D.Sc., F.R.S., Cambridge, and (3) Prof. G. A. R. Kon, M.A., D.Sc., F.R.S., the Chester Beauty Research Institute, London, appointed to adjudicate on the thesis "A Study of Some Vegetable Colouring Matters and Related Compounds", resolved that Mr. V. Venkateswarlu, M.Sc., be declared qualified for the Degree of Doctor of Science (D.Sc.).

*Nuffield Foundation Fellowship and Scholarships for the Advancement of Extraction Metallurgy.*—Notice has been received that the Nuffield Foundation, which has already done much to aid medicine, has just inaugurated a scheme with the object of advancing research and training in extraction metallurgy. The scheme is in three parts:—

(*a*) Five Travelling Fellowships are being offered each year to members of the teaching staff of universities and approved schools of mines and metallurgy within the Commonwealth and Empire. The object of this scheme is to enable teachers to visit important mining and metallurgical centres in the Empire in the long vacation in order to study the methods employed in those centres. The value of each fellowship will be up to £500 including the cost of travel. The duration of each fellowship will be approximately three months.

(*b*) Five Travelling Post-Graduate Scholarships are being offered each year for junior long vacaion in order to study the methods members of the profession who are graduates of universities and approved schools of mines and metallurgy in the Commonwealth and Empire and who have specialised in extraction metallurgy. Candidates will be selected not necessarily on account of their order of merit in examinations, but with regard also to their personality and general suitability. The value of a scholarship will be up to £500, including the cost of travel. The duration of a scholarship will not usually exceed six months.

(*c*) Ten Vacation Scholarships for students of mining and metallurgy at universities and approved schools of mines and metallurgy within the Commonwealth and Empire, to enable them to travel by air to important mining and metallurgical centres for vacation work. The value of a scholarship will be up to £200 to cover the cost of air travel.

The scheme has been drawn up in co-operation with the Institution of Mining and Metallurgy, which Institution will continue to assist the Foundation in the operation of the scheme.

Forms of application for scholarships may be obtained from the Secretary, Nuffield Foundation, 12|13, Mecklenburgh Square, London, W.C. 1.

*Fertilizer Factory.*—The proposed Rs. 10½ crore project for establishing a Fertilizer Factory at Sindhri in Bihar, which is expected to produce 350,000 tons of ammonium sulphate per year, is now well under way.

The supply of specialist plants, such as boilers, gas compressors, gas plant, turbo-alternators, etc., have been ordered from abroad at a cost of nearly Rs. 3 crores. Certain other categories of heavy plant must also be imported owing to lack of facilities for manufacture of the plant in India.

A good deal of other items can be fabricated in India and the Government of India have decided that as much as possible of such requirements should be manufactured and supplied indigenously. These items cover a wide range of plant and machinery, such as structural steel, cranes, tanks, steel water mains and certain classes of electrical equipment, etc. Opportunity is now open to Indian producers to manufacture and supply their products.

DR. S. L. HORA, Director of Fisheries, Bengal, has been elected as one of the fifteen Honorary Foreign Members of the American Society of Ichthyologists and Herpetologists.

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